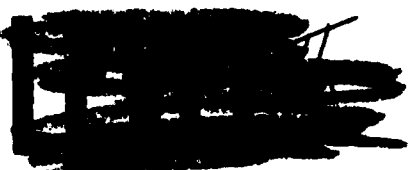


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ANALYZING GLOBAL INTERDEPENDENCE

by

Hayward R. Alker, Jr.
Lincoln P. Bloomfield
Nazli Choucri

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Volume III METHODOLOGICAL PERSPECTIVES AND RESEARCH IMPLICATIONS

by
Hayward R. Alker, Jr.
with Nazli Choucri

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This study is one of a number done by academic and other research institutions for the Department of State as part of its external research program. The program is planned and coordinated by the Department of State Research Council and managed by the Office of External Research in the Bureau of Intelligence and Research. It is designed to supplement the Department's own research capabilities and to provide independent, expert views to policy officers and analysts on questions with important policy implications.

On many occasions in recent years, both private citizens and government officials have talked and written about the trend toward increasing interdependence, with complex and shifting relationships, among the "actors" on the world scene. For obvious reasons, the emphasis usually is placed on economic relationships, although we are all aware that interdependence increasingly is apparent in other spheres as well--political, strategic, cultural, and so on. Indeed, one of the problems for any student of interdependence is posed by the linkages between or among such sectors.

As they thought about official and private studies and discussions of interdependence, a number of Department of State officers became convinced that at least some aspects of the phenomenon merited more serious or extensive scholarly attention. Do social scientists, they asked, have concepts and methods that can give us a more adequate understanding of the extent and nature of interdependence? Can they provide us with better means for checking assumptions that inform much of foreign policy?

The suggestion for a "conceptual and methodological" study of interdependence came from Mr. Herbert J. Spiro, of the Department's Policy Planning Staff. The detailed terms of reference for the study, designed as a guide for institutions interested in submitting research proposals on a competitive basis, were developed by Mr. Spiro and Mr. Pio D. Uliassi, of the Office of External Research, who served as the project monitor. Both drew generously from the comments of other Department officers.

We in the Department of State have already profited from the effort to define our own policy-related research interests in a more precise way from our meetings with the research team at M.I.T. and from the draft versions of this study that have been quite widely disseminated within our establishment. Our hope now, as it was when the project was first conceived, is that the published study will stimulate additional fruitful discussion and independent work on the problem of interdependence by private social scientists.

E. Raymond Platig, Director
Office of External Research
Bureau of Intelligence and Research
Washington, D. C. 20520

This study was supported by the Department of State under Contract #1722-320084. Views or conclusions contained in this study should not be interpreted as representing the official opinions or policies of the Department of State.

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ANALYZING GLOBAL INTERDEPENDENCE

by

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Hayward R. Alker, Jr.
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Volume III ·
**METHODOLOGICAL PERSPECTIVES
AND RESEARCH IMPLICATIONS**

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Hayward R. Alker, Jr.
with Nazli Choucri

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ANALYZING GLOBAL INTERDEPENDENCE

Volume I

ANALYTICAL PERSPECTIVES AND POLICY IMPLICATIONS

By

Lincoln P. Bloomfield and Hayward R. Alker, Jr.
with Ann Alker

Appendices by

Ann Alker and Steve R. Pieczenik

Volume II

ENERGY INTERDEPENDENCE

By

Nazli Choucri
with Vincent Ferraro

Volume III

METHODOLOGICAL PERSPECTIVES AND RESEARCH IMPLICATIONS

By

Hayward R. Alker, Jr.
with Nazli Choucri

Volume IV

SUMMARY

Prepared by

Irirangi C. Bloomfield

VOLUME III
METHODOLOGICAL PERSPECTIVES AND RESEARCH
IMPLICATIONS

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FOREWORD TO STUDY

ANALYZING GLOBAL INTERDEPENDENCE

In the summer of 1973 the U. S. Department of State awarded a contract to the M. I. T. Center for International Studies to conduct a year-long study that would, in the words of the R. F. P., "describe evolving patterns of interdependence in a multipolar world and develop new methods for projecting and appraising such patterns."

Given a projected level of effort of only nine professional man-months for the study, our governing research principle was to make maximum use of existing comparative advantages of the researchers involved, drawing to the greatest extent possible on previous or concurrent work they and their graduate students were doing. (It must however be said that all of us found ourselves entering new intellectual ground as our research proceeded.)

It was thus agreed that Professor Hayward R. Alker, Jr., would review the scholarly literature for issues, themes, approaches, and problems bearing on interdependence, and that he would also take responsibility for drawing conclusions concerning appropriate research methodologies. Professor Alker, drawing on substantial research papers on specific scholarly controversies, prepared (with Ann Alker) Chapter II of Volume I of the report. His methodological review appears as Volume III, in which Professor Nazli Choucri has coauthored the concluding chapter. Among the working papers developed in the course of that part of the project were the following, which are available on request from the M. I. T. Center for International Studies:

Lily Gardner, "Interdependence, Independence, Dependence, and Integration: Whither Western Europe?"

Fabio Basagni, "The New 'Political Economy' Controversy"

Ann Alker, "The Limits to Growth Controversy"

Richard Kugler, "Strategists and Their Critics: The United States National Security Policy Controversy"

Professor Nazli Choucrist took responsibility for developing a case study on energy interdependence, with some focus on the Middle East, that would serve the threefold purposes of: suggesting and applying an approach potentially useful in other sectors or geographic regions; illustrating some of the analytical problems, issues, and findings typical of scholarly interdependence controversies; and supplying some policy-relevant insights. Her report is bound separately as Volume II of the report. Professor Choucrist also coauthored Chapter IV of Volume III. She was assisted throughout her study by Vincent Ferraro, who contributed valuable research assistance, editorial help, and substantive criticism. Chapter V of Volume II was written with the collaboration of Ijaz Gilani. Major working papers, also available on request, are:

Vincent Ferraro, "Competing Transnational Energy Regimes"

Ijaz Gilani, "Interdependence and Community-Building Among Competing Regimes of the Arab World"

The third dimension of the study was the chief preoccupation of the undersigned, who also acted as coordinator of the project. My own approach follows a generally policy-oriented perspective. In Chapter I of Volume I, I sought to parse out the meaning of interdependence so that it might be approached with more clarity; in Chapter III, I endeavored to offer the outlines of a policy analysis leading to conclusions--which are my own--regarding some desirable policy directions. In the course of this research I asked Ann Alker to prepare a brief background paper on U.S. Nonfuel Mineral Import Practices, which as a useful assembly of data is included as Appendix A to Volume I. I also asked Steve R. Pieczenik, who in addition to being a practicing psychiatrist is a doctoral candidate in the M.I.T. Department of Political Science, to see what possibly relevant insights concerning dependency situations might be drawn from the psychiatric literature. His brief but provocative response is also included, as Appendix B to Volume I.

Although final responsibility remains with the cited authors, each of the principal authors read and commented on each other's contributions for this report, and we are all grateful for the help so received. Dr. Choucrist and I benefited from the helpful criticisms of our draft chapters by David A. Kay and Amelia C. Leiss, and I further profited from a review of my chapters by William Diebold, Jr. Professor Alker's work was critiqued in preliminary form by Robert O. Keohane and Ramkrishna Mukherjee. His research for Chapter III of Volume III

was assisted by Scott Ross. Finally, we had the opportunity to consider numerous comments from officers of the Department of State who reviewed the report in draft form.

While the contract did not call for a summary to be prepared, I increasingly felt the need for one, given the complexity of the subject matter and the fact that, despite the project's modest size, we were producing considerably more written material than we had anticipated. We therefore commissioned Irirangi C. Bloomfield, who has in the past performed numerous précis and editorial tasks for the Center, to prepare a summary volume, which we have denominated Volume IV.

My colleagues and I are grateful to Pio D. Uliassi of INR/XR for his tactful and understanding performance of the role of Project Monitor. We are very indebted to Jeanne Amnotte and to Dovianna Barrens, who succeeded her, for devoted and skillful handling of the manifold tasks of Project Secretary.

Lincoln P. Bloomfield
Project Director

Cambridge, Massachusetts
November 1974

CHAPTER I

A METHODOLOGY FOR INTERDEPENDENCE RESEARCH

by

Hayward R. Alker, Jr.

A. Outstanding Questions

The present volume attempts to shed light on the research issues raised by the previous volumes. The range of these questions is enormous: How should we conceptualize, measure, and evaluate interdependence costs, benefits, balances, asymmetries, and deficits? What are the relevant subjective and objective trends in international security, political economy, ecology, and community-building relations, including their underlying conditions, causes, and determinative structures? What future developments are likely, desirable, undesirable, possible, and at what costs to whom? Within the realm of governmental policy-making, what strategies of interdependence should be considered or advocated involving what actions, by whom, in what order, with what institutional bases? Surely appropriate answers depend on more or less adequate assessments of policy effectiveness, unintended outcomes, and the longer run institutional and environmental effects of both official and unofficial actions.

It should be clear that our brief research efforts in the earlier volumes have not definitively answered these questions. Consider but a few obvious examples. Chapter I and Appendix B, Volume I, highlight subjective features of dependency, while the dependency theorists mentioned there and in Chapter II, Volume I, emphasize objective, structural constraints on autonomous action. To what extent can both be right? The extraordinarily difficult analytic problem of "netting out" multi-issue cross-sectoral imbalances and their consequences has been identified, but remains unresolved in theory and practice. Both preceding volumes do succeed in insightfully revealing many of the complexities of the subject, but reliable and valid procedures for resolving these issues do not exist. Only piecemeal or judgmental relevance could at most be claimed.

Although all three principal authors of the present report favor selectively internationalizing various aspects of energy relations, the range of possible substantive and institutional foci for collaborative action revealed by Volumes I and II also precludes definitive assessment. Which energy regime alternatives among those considered in Volumes I and II should most vigorously be pursued? What are the underlying causes and constraints, the net benefits and costs associated with the dramatic change in relations among oil producers and consumers graphically portrayed in Volume II? Which arrangements would best lessen the strains arising from asymmetric dependencies?

If, as Professor Bloomfield persuasively argues, complete autarky is either impossible with desirable cost limits or historically counterproductive (cf. Figure 1, Volume III), where does the optimum exist in a generally attractive, but noninternational, strategy of lessening American, Canadian, and LDC dependency? Certainly the liberal ideas and ideals underlying these goals are not self-evident; they deserve reexamination and respecification.

B. Reasons for a Methodological Study

The above questions are designed not to criticize the earlier volumes, but to justify the need for further research on these and related questions. The present volume is but a small, methodological contribution to that effort. If more research is needed, we must ask the methodological question: how ought such research proceed? Such needs were also recognized in the original request for proposal, which asked for a review of concepts as well as "Techniques for Analyzing Global Interdependence." Here, then, are three obvious and sufficient reasons for the present volume: (1) the existence of important but unanswered research questions; (2) the need for a review of research methods and techniques relevant to the study of interdependence; and (3) the subsequent articulation of a research focus implied by increases in our collective understanding of what ought to be studied and how that study might be accomplished.

Underlying the need for research on "evolving patterns of global interdependence" is a more general two-way process. Governmental agencies want to suggest priority concerns for interested scholars and to learn more from research that is relevant to their concerns. Scholars seek recognition and stimulation for their work and opportunities to influence governmental thinking and action. The present volume is also designed to contribute to a second objective: the improvement of this two-way communication process.

C. The Methodological Strategy

Methodology is philosophy of research, applied epistemology. In a criticism-conscious fashion, it seeks to articulate persuasive, coherent, and feasible arguments about how research ought to be practiced. Research methods such as content analysis, gaming or computer simulation, may be thought of as clusters of operational research techniques and associated rationales for their differential utilization. As a research method, content analysis, for example, includes: techniques of automated tagging procedures used in document routing/retrieval systems; general inquirer computer routines; thematic coding procedures useful for scholarly or intelligence purposes; and manual techniques directed toward more intensive, particularistic analyses of source intentions and beliefs. The well-trained content analyst has also developed considerable sophistication concerning the applicability of such techniques to different problem contexts and the weaknesses and strengths of various ways of interpreting the results of such technical research.

Methodology comes between unanswered research questions and the choice among or invention of appropriate research techniques. Therefore a methodology is needed to assess the relevance of particular research techniques for interdependence research. And, explicitly articulated and agreed-upon methodologies are a prerequisite of fruitful communication among researchers as well as between governmental agencies and research scholars. When such do not exist, communication is frequently and confusingly at cross-purposes.

The strategy of exposition of the present volume is therefore as follows. First, in Chapter II, an effort will be made to find a set of analytical problems common to the very different scholarly perspectives reviewed in Chapter II, Volume I. Without any claims of uniqueness, an eclectic, partially synthetic methodological approach will then be offered in the second half of Chapter II as a relevant methodological focus for interdependence research. The validity of such a synthesis depends, however, on a deeper level of scholarly understanding than was provided in Chapter II of Volume I. Its relevance to the previously mentioned common analytical problems will nonetheless be argued. And its compatibility with Professor Bloomfield's policy/bureaucracy perspective will be partially demonstrated.

Then, in Chapter III, this methodological focus will be further articulated in terms of canons (maxims) of methodological relevance sufficiently precise to allow judgments of approach/technique relevance

to interdependence research. Chapter III concludes with a review of several dozen technical academic studies particularly relevant to interdependence research, giving special attention to previous research by Professors Alker, Bloomfield, and Choucri. Some general methodological conclusions follow about matching research techniques to interdependence research needs.

It is not expected that such a review can totally be grasped by those unfamiliar with the technical research studies in question. Nonetheless, a short report such as this must assume such familiarity. The review of techniques in Chapter III may thus seem more oriented toward practicing research scholars contemplating interdependence problems than toward government analyses. It, however, is hoped that the multilevel analytical conceptualization of interdependence phenomena in Chapter IV will be generally intelligible. It is my conviction that the application of that scheme or some other equally clear conceptualization would help to sharpen the analysis underlying official pronouncements on interdependence, as reviewed and preliminarily classified in Bloomfield's Chapter I, Volume I. Professor Bloomfield's own definition and measures of interdependence will also be shown to be an important special case of this more general conceptualization.

The final chapter, Chapter IV, then aggregates the methodological maxims of Chapter III. To the extent that the methodological approach of Section B of Chapter II is found by government analysts to be a helpful one, these maxims can be useful as a list of twenty questions to ask throughout the public sector in reviewing research proposals for interdependence relevance.

In order to provide a concrete example of what is implied by the methodological perspective of Chapters II and III, the concluding chapter illustrates as well the steps that should be taken in studying energy interdependencies. This final chapter, coauthored with Professor Choucri, thus provides an opportunity for articulating the methodological insights gained from the energy case study of Volume II and reconciling them with the present approach without limiting the relevance of this volume's methodological orientation. This outline suggests a particular kind of research needing further Department investigation. That such relevance is possible in other areas of research, including commodity interdependencies, will be the final argument of the present volume.

CHAPTER II
COMMON ANALYTICAL PROBLEMS:
A PARTIALLY SYNTHETIC APPROACH

by

Hayward R. Alker, Jr.

This chapter will suggest a partially synthetic methodological approach to a series of analytical problems commonly found in the controversies, issues, and policy options reviewed in Volumes I and II of this report. To be responsive to such concerns without prejudging the major issues, a broad synthetic framework is called for. But no such effort is completely inclusive, hence the partial nature of the present effort. What appears to be needed is a design-oriented, historical systems approach focused on cross-state world order possibilities, emphasizing competing quasi-regime alternatives. The elucidation and justification of this methodological orientation depends on its relevance to analytical problems in each of the previously studied issue areas. Subsequent chapters will articulate and apply this approach to the review and development of issue-specific research designs and techniques.

A. Common Analytical Problems in Interdependence Issues

The analytical problems we extract come from the scholarly interdependence controversies of Chapter II, Volume I, as well as the energy case of Volume II, and the policy options delineated in Chapter III, Volume I. They derive mainly from the perceived growing complexity of global politics. This involves more actors with more objectives, increasingly sensitive to others' actions, unilaterally controlling fewer relevant instruments. Actors are often subject to greater environmental constraints and are immersed in a larger number of policy issues, many of them with fundamental structural implications, requiring joint actions for their resolution. Positively put, these complexities of a post-Cold War era provide new opportunities for individual or collective action.

Without having empirically validated such positive or negative interpretations, we can still define the core analytical problem. Bloomfield's conclusion to Chapter I, Volume I, suggests the key uncertainty: ". . . the degree to which one is reciprocally dependent on others for what things of value, at what cost to one or both, with what benefits to one or both, and with what implications for other aspects of foreign policy or domestic life." Given the increased relevance of other actors in achieving both domestic and international objectives, it seems much harder, but more necessary in today's increasingly complex world scene from a variety of official and nonofficial perspectives, to answer the slightly more general questions: who gets, or should get, what, why, how, at what cost, when, with what (perhaps unintended) side effects? In subsequent pages, we shall break down this problem into some of its most important parts.

But before doing so, it is worth reemphasizing the structure-sensitive aspects of interdependence issues and options. It is hard to reconcile policy analysis orientations assuming fixed global structures with design concerns directed toward structure change. Each of Volume I's scholarly controversies, Professor Bloomfield's policy perspective, and the energy case of Volume II evidenced growing concern with designing and implementing new, if partial, world orders: system strategies for restructuring policies, transactions, interests, relationships, and regulative institutions so that objectives might be realized in a mutually satisfactory, hence orderly and enduring, fashion.

In these areas normal policies continually run into structural issues. Consider "normal" examples from Volume I: armaments development policies, inflation, or payments controls end run by multinational banks or corporations, commercial fishing practices, American-Canadian pipeline development (to take a case of troubled pluralistic regional integration closer to home than Europe), or atomic energy technology transfers. Structurally speaking, we must worry about unstable arms races, the breakdown of global monetary control systems, Canadian dependency, and Middle East security. Two (Chapter III, Volume I) of the main classes of policy options (reducing risks and using asymmetric interdependencies for bargaining purposes) assumed relatively fixed overall dependency patterns, while other policy options were system-changing strategies (reducing risks, reducing dependency, increasing authority or increasing mutual dependency). A closer look within even the "normal" options, however, sustains the point that the success of even "normal" interdependence policy options is often structure dependent.

1. Mixed Interest, Interaction-Contingent, Collective Outcome Dilemmas

The first analytical problem common to each of the substantive areas we have reviewed is that they are mixed interest, interaction-contingent, collective outcome dilemmas. Such problems have frequently been discussed under labels like the game of Chicken or Prisoner's Dilemma. A few paragraphs are necessary to articulate their essential characteristics.¹

Such games are usually represented in normal form:

		Actor B	
		Option 1	Option 2
Actor A	Policy Strategy Option 1	Outcome ₁₁ (U ^A ₁₁ , U ^B ₁₁)	Outcome ₁₂ (U ^A ₁₂ , U ^B ₁₂)
	Policy Strategy Option 2	Outcome ₂₁ (U ^A ₂₁ , U ^B ₂₁)	Outcome ₂₂ (U ^A ₂₂ , U ^B ₂₂)

¹A longer, often insightful exposition of their relevance to U.S. - U.S.S.R. security relations is Glenn H. Snyder, "'Prisoner's Dilemma' and 'Chicken Models' in International Politics," International Studies Quarterly 15 (March 1971), pp. 66-103. See also Thomas Schelling, "A Framework for the Evaluation of Arms Proposals," Discussion Paper No. 210, Public Policy Program, Kennedy School of Government, Harvard University (January 1974). It should be added that, were our exposition to focus on the "chicken" analogy (which has lower payoffs for cooperation), more attention would be given to the bluffs and threats often characteristic of conflictful situations.

The four cells represent different outcome possibilities and contain the utility payoffs associated with different choices of the strategic options available to players A and B.

In the Prisoner's Dilemma interpretation of such a simple game, the District Attorney faces two apprehended prisoners (A and B), held incommunicado from each other, with the options of confessing or not confessing the whereabouts of "the stolen goods." If either confesses singly, turning state's evidence produces a historical record, and brings him a high reward, such as a suspended sentence; the other gets the book thrown at him. Both confessing means they get convicted with something less than the worst sentence; both not confessing means the District Attorney cannot find "the stolen goods" and can only get convictions and jail sentences for a lesser charge, such as breaking and entering.

A typical "payoff matrix" in this case (and others similar to it) looks like:

		B	
		don't confess/arm/overfish	confess/arm/overfish
A	don't confess/arm/overfish	5, 5 DA ignorant, lesser sentences, etc.	-10, 10 A gets suckered by B, etc.
	confess/arm/overfish	10, -10 B gets suckered by A, etc.	-5, -5 Long jail sentence for both, etc.

It becomes very clear upon reflection that the independently acting prisoner will be sorely tempted (even rationally encouraged in an economic sense) to confess or "rat on" or try to "sucker" the other prisoner he cannot talk to, make enforceable agreements with, or trust. Yet independent utility maximization in these terms is mutually defeating: a cooperative outcome is clearly preferred by both. The

same dilemma may well occur in some arms acquisitions, fishing, inflation control, or oil production situations.

The fact that the structuring of these outcomes can be described both collectively (joint conviction on a lesser charge, balanced or unbalanced arms levels, total catch magnitudes) or individually (who goes to jail, who has which arms the other does not, who gets what from their inflation controller or oil production policies) would be obscured by the normal game-theoretic schematization, which only puts utilities in each of the four outcome cells. But in interdependence thinking the distinction between collective outcome possibilities and individual ones is important: depletions of ocean stocks, District Attorney ignorance about the location of the stolen goods, or the existence of global inflation controls are shared by everyone whether they like them or can control them. Idealized, such wholistic or systemic outcomes are called pure public (or collective) goods or bads: one's consumption of them does not diminish another's. It may also be impossible to prevent such consumption or impossible to get paid for producing such goods. At the level of individual actors, collective outcomes generate what we shall call consumption interdependence.

Institutional liberals usually argue that governmental effort (or binding agreements among prisoners afraid of getting the book) is necessary to produce efficient amounts of such goods because of another collective feature, "imperfections" in their property titles. Not enough collective goods and too many public bads are produced when coercively effective tax or agreement structures do not exist. Ruggie claims that the increased pursuit of pure or impure public goods (including regulations of public bads) is a characteristic of modern, post-industrial societies at the national or international levels.²

Now let us show how the production of goods with collective outcome aspects can involve interaction contingencies. If it is the case that O_{12} is different from O_{11} (and/or O_{22} different from O_{21}) we say that Prisoner A's strategy alternatives are interaction contingent with B's. He is not independently able to control his outcomes (whether or not he goes to jail and for how long). One could also extend the idea of interaction contingency to analogous complications arising from separate actions taken by the same actor to achieve different objectives.

²John Gerard Ruggie, "Collective Goods and Future International Collaboration," American Political Science Review 66 (1972), pp. 874-893, at p. 874.

Interaction contingency is a causal matter. Measurable in terms of the magnitudes of the differences involved, A's causal dependence on B may be greater or less. It often has a historical dimension. Thus A's actions (and B's) are not additive in their effects in jointly contingent situations. Causal interdependence here refers to mutual or reciprocal causal dependency.³

Similar claims that international autonomy in monetary matters is decreasing, that deep sea fishing alternatives are more contingent, that A's oil volume-price production options are causally dependent on B all derive from prior assumptions about the causal rubrics and historically implicit ground rules of their natural and social (including economic) environments. This is the second very general structural level of which it is meaningful to talk about international interdependence as interaction contingency.

Differences in individual capabilities to affect outcomes over which A and B have differential preferences allow definitions, like those in Volume I, of situations of asymmetric sensitivity interdependence (B's possible effects on A's jail terms are of a greater magnitude than A's) and balanced sensitivity interdependence (the case of equal effects). Recalling Cooper's usage in this regard,⁴ think of A's anti-inflationary strategies affecting B's control possibilities and vice versa. We do not have to know precisely what national inflation-growth trade-offs exist to recognize sensitivity interdependence.

One could go further and talk more precisely and teleologically about the functional interdependence necessary for producing and ensuring individual or collective goods. To do so assumes a third level of structured relations, that of productive tasks and operational practices and ordinary game play. These in turn may further be governed by more or less institutionalized generative/regulative norms and values, which I distinguish as a fourth level of analysis. New or renewed game rules, for example, belong at this level of analysis. So do novel, collectively produced solutions to consumption externalities that were public bads.

³A sophisticated statistical literature exists on interdependent systems, sets of causal relations in general characterizeable as simultaneous and in part as reciprocal and controllable dependencies. See Hayward R. Alker, Jr., "Causal Inference and Political Analysis," in *Mathematical Applications in Political Science*, vol. 2, ed. Joseph Bernd (Dallas: SMU Press, 1966).

⁴Richard Cooper, The Economics of Interdependence (New York: McGraw-Hill, 1968).

Scholars analyzing repeated game practices systematically introduce utilities on preferred or disliked outcome possibilities for theoretical and measurement purposes; actors usually do so more or less implicitly for comparative, productive purposes. We can characterize mixed interest situations in terms of the interdependence of utility interests. We shall do this in a way consistent with prior definitions of consumption interdependence, causal interdependence, sensitivity interdependence, and functional interdependence. Let $U_{ij}^A = U^A(O_{ij}) = U^A(A_i, B_j, C_k)$ be the utility A places on the outcome O_{ij} associated with A taking action i and B following strategy j in natural and social causal context C . Recall how Volume I summarized debates about the sign or extent of the covariance of actor utilities over available action alternatives. For example, this was more positive among the United States and its allies in a time of high insecurity. Mixed interest situations are those with neither purely positive or purely negative interest interdependence. A and B are positively interest interdependent (have no conflict of interest) when each one's action possibilities leading to his own higher utilities also enhance the other's utility payoffs.⁵ Negative interest interdependence, like pure conflict situations, suggests that when one nation does well, another does poorly. Mixed interest situations come somewhere in between.

Now we make the main point: each of the issue areas we have examined in Volumes I and II has important analytical problems characterizable as mixed interest, interaction-contingent, collective outcome dilemmas. Cooper's review of GATT as a self-denying ordinance designed to prevent Prisoner's Dilemmas, like the tariff/

⁵A rigorous definition of conflict of interest is given in Robert Axelrod, Conflict of Interest (Chicago: Markham, 1970). It allows measures of degrees of conflict of interest in the case where interpersonal comparisons of utility are possible. "Interests" can then be defined and compared in terms of contemplated or actual utility payoff possibilities. The textual definition above does not require such comparisons, being defined in correlational terms, but can be easily extended to such a case. We have also avoided discussing the interesting case (sometimes called utility interdependence) in which one actor's utility assessment of outcomes depends on another's assessment. Rivalry and sympathy usually generate such interdependence.

devaluation wars of the 1930s, fits well here.⁶ Ruggie's treatment of international organizations as public goods providers⁷ sometimes responding to the externalities of new technologies generalizes one frequently offered resolution of the Prisoner's Dilemma. The collective good here, like nondefection to the District Attorney, is usually thought of as a viable regime of technology regulation. Related theoretical developments are used by Olson and Zeckhauser to estimate "fair" alliance cost shares, and by Russett and Sullivan to reconceptualize integration studies. Kissinger's 1968 thoughts about designing a world security system have a very similar flavor, reflected in Harrison Wagner's qualified assertion that national security is a public good shared more or less equally among a nation's citizens. Brian Pollins has argued that producer attempts individually to determine oil prices before 1970 produced collective bads (from the point of view of national producers).⁸ Arms race theorists might similarly wonder, with Glenn Snyder, if détente might be seen in the same terms. Dennis Meadows' valiant efforts to square Forrester's Malthusian circle appear to exhibit a similar inclination. Hardin's "Tragedy of the Commons" represents a clearer version of the Prisoner's Dilemma problem in an ecological case, even though the compellingness of appeals to global ecological balance is often debated.⁹ Pollution-controlling nations might then be considered losers playing Chicken!

2. Pervasive Units of Analysis Problem

The need simultaneously to consider policy/structure dimensions has another immediate consequence. With the increasing importance

⁶Cooper, The Economics of Interdependence.

⁷Ruggie, "Collective Goods and Future International Collaboration."

⁸Brian Pollins, "Transnational Oil Regimes: The Prisoner's Dilemma Game as a Descriptive Model and the Cooperative Solution as a Collective Good" (Cambridge: M.I. T., 1974), unpublished. The Olson-Zeckhauser paper and the Russett-Sullivan update have been discussed in recent issues of International Organization. Wagner's work is as yet unpublished.

⁹References to these latter issues are given in Ann Alker's project paper on "The Limits to Growth Controversy" (Cambridge: M.I. T., 1973), unpublished.

of transnational and transgovernmental actors, the pluralization of recognizable international issues and the increase in identity/loyalty conflicts (noted in Volume I, Chapter II) have generated a pervasive unit of analysis problem. Whose interests, at what level of analysis, should we consider? The different levels of structural analyses implicit in collective outcome dilemmas highlight the problem. If we are looking for emergent creative/regulative political orders, or opportunities for some such possibilities, it is clear methodologically that our studies must be done at close to a global normative level of analysis. To the extent that existing forms of supranational, transgovernmental, governmental, or transnational actors have collective identities, capabilities, and generative/regulative purposes informing current policies and operational practices, they too must be considered. This larger collection of relevant units we refer to as cross-state actors. Competing, parochial, functionally limited, weakly coordinated approaches to world order-building are in part consequences of détente-accelerated pluralization of cross-state actors with different identities and loyalties.

Because the formal, legal organization of international relations does not correspond to its political organization, we need cross-state data. For example, we need a lot more information on order-building efforts than the texts of treaties signed by foreign ministers. Questions arise like: Which actors in the illegal "nonwars" should negotiate their settlements? Are the dominated groups in center/periphery linkages entitled to positions at the conference table or in the policy analysis calculus? What about bureaucratic changes within national actors or transnational guerrilla groups that help or hamper larger regional accommodation efforts so necessary if Middle Eastern stability is to underlie secure oil flows?

3. The Need for Comparative Costing of Multiple Objectives

Just as the focus on policy outcomes plus structural effects highlights units of analysis problems in the contemporary world, so it complicates the comparative costing of multiple objectives. It has always been difficult to assess the foreign policy options of world political actors because foreign policy opportunity costs are more important than monetary costs. The interdependence literature highlights a related need: making commensurable narrow, short-run policy payoffs and broader, larger run order-building efforts. Resource costs and opportunity costs are involved. Interpersonal comparisons must go into political designs as well. Multiple objectives follow from the multiple interests of sensitivity-interdependent multiple actors whose relevance we have already noted. Political economy controversies,

and related research paradigms, are similarly driven by different commitments to the values of autonomy, efficiency, and equity. Bloomfield's policy analysis in Volume I highlighted a "balance" norm involving both autonomy, capability, and equity aspects. But evaluating objectives comparatively does not answer the question of which objectives to pursue and which policy instruments to develop or use to what extent. Here another analytical problem commonly arises, as already noted in Volume I.

4. The Instruments-Objectives Constraint

A fourth core problem, the instruments-objectives constraint, has its intellectual origins in the cybernetic law of requisite variety. One version of this constraint states that there must be as many independent policy instruments as there are objectives if success is to be hoped for. Cooper has argued this point in the context of multiplying economic objectives (growth, low inflation, high employment, good balance of payments, and free world economic integration), and increased U.S. sensitivity to foreign economies. Supranational neo-functional technocrats rely on the inability of merely national policy instruments for the weak and their possibilities of task expansion. Military debates about strategic deterrence plus damage limitation plus theater-specific deterrence plus maintaining a strong military/industrial power base repeatedly bedevil those trying to make efficient budgetary allocations for national security. Which highly improbable scenarios should we worry about with respect to these objectives is another complicating aspect of the instruments-objective problem in the military security case. The unavailability of globally effective governmental policy instruments is a major reason why Forrester prefers a retreat to more locally and autonomous management of national eco-systems. It may also account for the limited success of coordination/regulation efforts in nonisolatable international sub-systems. Such discussions of policy and structure alternatives cannot avoid complex inference questions about the underlying environment and historical-causal interdependencies; they will not be resolved without consistent, sufficiently articulated and flexibly administratable policy goals.

5. The Likelihood of Unanticipated Negative Consequences

A fifth analytical problem, the likelihood of unanticipated negative consequences, has been capsulized in Forrester's remarks about population control policies and the counter-intuitive behavior of non-linear, circularly causal social systems. Highly technical work by

Ando-Fisher-Simon on interdependent, nondecomposable systems makes a similar point of direct relevance to the intimately connected, but weakly coordinated, partial international systems noted above.¹⁰ Forrester's notion of counter intuitive outcomes is usually linked to a specific causal-historical idea of interaction contingency, called by Forrester sectoral interdependence: non-Malthusian population control policies do not work because they feedback through the economic sector as well, undermining the relevant incentive structures. Simon's ideas are more closely related to the levels of operational practice and institutional innovation or renewal. At these levels organizational theorists and neofunctionalists stress the related idea of functional interdependence. "The greater the specialization by sub-programs . . . the greater the interdependence among organizational sub-units."¹¹

Consider some more examples. From an integrationist perspective, Karl Deutsch has emphasized how operational war decisions since about 1905 have frequently been self-defeating.¹² The ramifications of self-interested monetary devaluation decisions for the larger economic order and national socioeconomic contexts seem to have been analogously counterintuitive, requiring complex causal understanding. Myrdal's vicious circles of development policies are to be chosen. Energy policies designed to increase national autonomy may be similarly self-defeating if they introduce greater functional interdependencies in the nuclear energy field. From an alliance theorist's perspective, the Kennedy/McNamara cancellation of Skybolt for domestic reasons had perhaps as much effect on pushing Europe toward a Gaullist design as the Soviet invasion of Hungary did on Chinese rapprochement with the United States.¹³ Radical critiques of U.S. /U.S.S.R. high strategic interdependence, great power nuclear war readiness and constant military mobilization have similarly argued

¹⁰Albert Ando, Franklin Fisher, and Herbert Simon, Essays on the Structure of Social Science Models (Cambridge: M.I.T. Press, 1963).

¹¹James March and Herbert Simon, Organizations (Chicago: Rand McNally, 1955), p. 159.

¹²Karl Deutsch, private communication.

¹³Richard Neustadt, Alliance Politics.

the counter-intuitive, latent-functions of competitive war readiness in maintaining insecurity through armament.

6. The Need for Counterfactual Systems Assessment

These last examples immediately raise the question of counter-factual systems assessment and suggest other kinds of interdependence, simultaneously definable at the levels of sociocausal contexts, operational policies, and generative or regulative principles. Many analysts speak in multilevel structural terms of systems of interdependence. Normatively the realist wants to ask about whether there are feasible, preferable, as yet nonexistent (and therefore counterfactual) alternatives to vicious cycles of underdevelopment or insecurity. To say such systems are vicious is to imply, as Marxists would also agree, that there are better alternatives available.

Structural sensitivity in these problem areas has got to go beyond the kinds of interdependence (of consumption, sensitivities, and interests) we discussed concerning Prisoner's Dilemma and similar mixed-interest, interaction-contingent, collective-outcome situations. System effects, system costs, and the higher order causal processes of system building, maintaining, and transformation are involved. There are also structure-changing processes of inventing new strategy options, breaking down communication barriers, changing game rules, and redefining multi-objective utility functions that evaluate payoffs and their structural contexts. Cost-conscious security and community theorists talk in terms of mutual vulnerabilities. There is the need to consider seriously whether the game should be played at all, how frequently, for what stakes, and the costs of doing or not doing so. Keohane and Nye define vulnerability interdependence in terms of the opportunity costs of feasible transformations or terminations of mutual systemic relationships.¹⁴ Bloomfield's earlier discussion of regional resource autarchy and self-sufficiency as a possible policy option again implies the feasibility of such a counter-factual alternative. Dependency is par excellence the case of asymmetric vulnerability interdependence: one nation could break a multilevel relationship with relative ease; another could not.

¹⁴Robert Keohane and Joseph Nye, "International Interdependence and Integration," in Handbook of Political Science, ed. Nelson Polsky and Fred Greenstein (Reading, Mass.: Addison-Wesley, forthcoming).

B. Components of a Partially Synthetic Methodological Approach

A brief review of analytical issues helps convince the methodological skeptic that important and difficult analytical problems can be distinguished from political ones, even if their separation is always less than total. Moreover, the frequent recognition of such problems by scholars of different paradigmatic orientations in different content areas of concern suggests both their centrality in the controversies we have looked at, and their possible relevance to the "real world," seen so differently through opposed scholarly glasses.

Thus, we shall ground our methodological remarks in the above list of analytical problems. Although resulting methodological developments will not solve political problems, there is some small hope--to the extent that ideas move structures--that reconceptualizations of various scientific and prescriptive questions may make possibilities for governmental action more apparent, more genuine, more likely, and more globally effective.

1. A Historical Systems Approach

The first component of a synthetic methodological approach to interdependence issues, options, and problems is a historical systems approach. By this I mean some combination of generalizing historical analysis combined with the multilevel-structure-sensitive viewpoint outlined above and the elaborations characteristic of modern systems theory. Deutsch, Lenin, Hoffman, Morgenthau, have all done exemplary studies of generalizing historical analyses. Forrester, Haas, Kaplan, Rosecrance, and Young may be exemplary figures combining the former and the latter systems theory and strategy interests.¹⁵

More specifically, analyses of interdependent relationships should be grounded in a historical context formally noted, but not spelled out in our hypothetical Prisoner's Dilemma exercise. This requires detailed attention to the substantive trends of the sort mentioned briefly in Volume I, and more fully analyzed for the energy case in Volume II of this report. This means historical variants in

¹⁵A good feel for many of these perspectives would come from a review of International Politics and Foreign Policy: A Reader in Research and Theory, ed. James Rosenau (New York: The Free Press, 1969).

national, transnational, and transgovernmental units of analysis must be taken into account. Design alternatives, if they are to be at all elaborated, should be based upon deep familiarities with relevant histories and plausible precedents. A dynamic view of socio-political processes should link inner objectives and constraints across artificial interfaces with external environments. Such links are always empirically important, and are now one of the current pre-occupations of interdependence theorists.

Systems theories containing historically interpretable operational rule specifications have enough precision for deductive or predictive analyses of a Kaplan or Alker-Christensen-Greenberg sort¹⁶ and allow design analyses using competing evaluative terms. More formally, modern systems theories are developing vocabularies in terms of which more partial research paradigms can be reformulated and compared. They also provide measures of systemic "evolution" or "adaptation" or "environmental transformation" necessary to make sense out of world order issues.

2. A Focus on Partial World Order-Building Efforts

If a structurally sensitive historical systems approach resonates with much of the previous discussion, a focus on partial world order-building efforts has been only slightly less emphasized. Identified in Chapter II, Volume I, as a surprisingly common pre-occupation of both idealistic community builders and realistic power manipulators, Marxists and Liberals, this emphasis was a main concern of Volume II and Bloomfield's policy review.

Post-functionalists distinguish different spheres of interest interdependence--those where fragmentary community-building efforts have a real basis in positively covering interests and those that do not, somewhat like Herbert Spiro's previously described idea of interdependence. Donald Puchala has defined "concordance systems" somewhere between cooperative integration and violent conflict such as the

¹⁶A recent report on this research is Hayward Alker, Jr., and William Greenberg, "Analyzing Collective Security Regime Alternatives," forthcoming. Historical practices concerning interpretation and application of collective security "precedents" give this research high relevance to systems strategy analysis.

Common Market "wherein actors find it possible consistently to harmonize their interests, compromise their differences and reap mutual rewards from their interactions."¹⁷ The Integrated Emergency Program in Case of a New Interruption of Oil Supplies of the twelve-member Energy Coordinating Group is perhaps the most recent example of a partial world order-building effort at the level of regenerative norms. Its key regulative rules are agreements in an emergency to cut oil consumption by a common rate, to develop a common level of emergency self-sufficiency and to combat selective embargos by emergency reallocations.¹⁸ Professor Bloomfield, in a related context, has argued that "The major forces affecting human life on the planet are increasingly trans-national and require purposeful steps toward world order."¹⁹

Perhaps the most articulated goal-concept of interdependence in pluralistic world order terms is Miriam Camps processual definition: (1) abatement of the arms race and progress toward disarmament; (2) substitution of peaceful processes of change for violent ones; (3) achievement of peaceful settlements of disputes through some kind of decentralized collective security; (4) more efficient and ecologically sound use of public and private global resources; (5) improvement in economic welfare; (6) improvement in the quality of life; (7) some narrowing of North-South wealth disparities; (8) some narrowing of weak-strong power disparities; (9) protection and advancement of human rights including the right to individual and collective diversity and autonomy.²⁰ With different emphases and different conceptual interpretations, conservatives, liberals, and radicals from North and South talk about most of these same interdependence objectives, at least regionally or globally.

¹⁷Donald J. Puchala, "Of Blind Men, Elephants, and International Integration," Journal of Common Market Studies, vol. 10, no. 3 (1972), p. 277.

¹⁸U.S., Department of State, "Integrated Emergency Program in Case of a New Interruption of Oil Supplies" (Typewritten, n. d.)

¹⁹Lincoln P. Bloomfield, In Search of American Foreign Policy: The Humane Use of Power (New York: Oxford University Press, 1974), p. 159 (italics removed).

²⁰Miriam Camps, The Management of Interdependence: A Preliminary View (New York: Council on Foreign Relations, 1974), p. 157.

Any kind of "evolution" in global patterns of interdependence must by definition involve structural change. It is likely to be identified in terms both of enhanced subunit autonomy and more enduring world order structures. Such structures, when defined in a multi-level fashion and analyzed in terms of their coordinating rules, can be classified (and will be below) into anarchies, quasi-regimes, and regimes. As policy options, quasi-regime-building tends to be, but is not always, more multilateral than the bilateral emphasis of Chapter III, Volume I. But it may also be combined with selective moves toward isolation and vulnerability reduction, as well as environmental transformations.

3. Design Research on Interdependence Alternatives

A third feature of our proposed synthetic framework is an emphasis on design research, the analysis of alternative, artificial systems of global interdependence. The immediate point to emphasize in the light of many different political programs being put forward for achieving "world order," "ecological balance," "economic stability," "secure oil," or "peace" is that any such order will be artificial, not natural. It will not be sanctified by some evolutionary law of nature, but will be the higher level product of human efforts vis-à-vis the historical - causal constraints of environmental context and the operational practices of normal official and unofficial cross-state relations. It must start from the realities of the present, but like the present, the future will be largely constructed.

For the "sciences of the artificial," Herbert Simon sets the following boundaries:

1. Artificial things are synthesized (although not always or usually with full forethought) by man.
2. Artificial things may imitate appearance in natural things, while lacking, in one or many respects, the reality of the latter.
3. Artificial things can be characterized in terms of functions, goals, adaptations [and environmental transformations].
4. Artificial things are often discussed, particularly when they are being designed, in terms of imperatives as well as descriptives.²¹

²¹H. A. Simon, The Sciences of the Artificial (Cambridge: M. I. T. Press, 1969), pp. 5-6.

Hence, world order-building is, at best, an "artificial science," requiring a design research orientation toward problems of generative/regulative significance.

Note also how a design interest fits with the previous list of analytical problems. Like many other piecemeal order-building efforts, Prisoner's Dilemmas can be conceived of as objectively and subjectively constrained design problems. They suggest the bankruptcy of a strategy of pure independence. The problem is how can game players and District Attorneys mutually design their game play and their historical-causal contexts so as to avoid collectively irrational outcomes? Dilemma resolutions occur through synthetic restructuring of the actors, the current game situation, their game play, or its action-outcome interaction possibilities. The objectives-constraint problem is also characteristic of, and intrinsic to, any realistic design interest governed by multiple functions, goals, or adaptations. Simon divides constraints into those that are part of a system's inner environment (thus conceivable as domestic public goods to be maintained or modified by political action) and those reflecting an external natural, social, technological environment.

Designs by engineers or architects may be thought of as interfaces between these two environments. The often unanticipated consequences of such artificial creations are the results of complex causal interactions going through such interfaces in both directions. Designs for human systems always face units of analysis problems, as they try satisfactorily to coordinate and benefit a multiplicity of interconnected actors, designers included, with multiple imperative concerns. For example, in the Prisoner's Dilemma, which combination of prisoners and district attorney does the reader identify with? Which should he study? Realistic designs must also reconcile existing, hard-to-change conditions and practices with restructuring concerns. Hence both normal policy and systems strategy perspectives are appropriate.

A focus on interface problems brings us close to the need for regime/quasi-regime/anarchy distinctions. To motivate this development, consider how sequential Prisoner's Dilemmas or Chicken games are resolved in those cases where natural, social, and technological environments (other than communication possibilities) are largely non-manipulable but their effects are somehow regularizeable.

Are not historically imagined principles or learned precedents applied to game play in a more or less successful way? Should not

collectivizing some aspects of the means of production be considered? Is it not by the development of regulative rules and/or institutions for coordinating expectations and behavior so that mutually satisfactory, predictable, and, hence, stable outcomes occur in mixed interest, interaction-contingent, collective outcome situations?²² Whether or not particular generative/regulative "rules" or "cues" or "understandings" develop making Chicken or Prisoner Dilemma games less lethal depends on hard-to-predict consequences of game histories, including sequences of reward and punishment outcomes. Possible divergences and contradictions are likely between operational coordinating rules, context-based ground rules or constraints, and practices attempting formally to revise or regulate operational behavior vis-à-vis other actors and natural and social environmental contexts. This multilevel distinction between ground rules, operating rules, and generative/regulative norms should, therefore, be preserved. It suggests interesting dynamical analysis of quasi-regime practices.

4. An Emphasis on Competing Cross-State Quasi-Regimes

Let us define quasi-regimes as multilevel rule systems governing certain expectations and behaviors of two or more cross-state actors with respect to each other and their natural and social environments. A regime in the fuller sense of the term may be characterized as a quasi-regime evidencing (a) mutuality or publicness of its benefits; (b) multilateral consensus on its rules among major participants and directly affected transgovernmental actors; (c) substantial stability, coherence, and effectiveness; and (d) the institutionalization of its systemic-environmental relationships. Rule systems satisfying only some of the above are, by default, quasi-regimes. The Integrated Emergency Program of the Energy Coordinating Group would be an example of a quasi-regime; its tentative, untried nature vis-à-vis points (c) and (d) clearly disallow the accurate use of the "regime" level. Except when such differences between regimes and quasi-regimes need emphasis, we shall often, however, use the shorter phrase below.

²²I have elaborated these points in my 1973 IPSA paper entitled "Are There Voluntaristic Structural Models of Public Goods Generation?," a longer version of which will soon appear in Quality and Quantity. Being suspicious of applying such simple analogies to international relations, I only do so because of the pervasiveness of such arguments in the interdependence literature.

Nations desiring greater autonomy obviously resist regime candidates constricting desired options and encourage those facilitating them. World order structures not containing quasi-regimes might best formally be described as anarchies in an unregulated, Hobbesian, or Rousseauian sense. Note that without superordinate authoritative sanctioning systems, even regimes in the full sense are not world governments. In the present historical context, most piecemeal world order-building efforts obviously will yield something a good deal less global, sanctioned, legitimate, and effective than world government. They may have many of the devolutional aspects noted by post-functionalists. Hence the introduction of intermediate, but possibly transitional, quasi-regime categories seems an appropriate emphasis within our methodological synthesis.

"Détente," "special relationships," "operational codes," "rights to consultation," "cooperative dependency relations between multinational corporations and certain government bureaucracies" are the coin of much structure-sensitive contemporary interdependence policies. It is my hope and intent to consider such relationships as quasi-regime candidates, whose multilevel rule structures often need further articulation and analysis. When successful, they usually breed efforts for their fuller implementation and institutional obligations.

Why talk about competitive cross-state regime alternatives? Our sixth common analytical problem requires it. Both the energy case study and many features of our interdependence controversies point toward the study of subgovernmental, supranational, and transnational influences on regime development. In addition to research paradigm cleavages, these can lead to cross-functional conflicts within governments and international organizations, and between power centers in a multipolar world. Oil, coal, and atomic energy system alternatives are obviously differentially attractive to such actors. As more or less fully realized artifacts, regimes also create value-doctrine tensions vis-à-vis other regime "models" or status quo positions. Like integration and security theories, energy politics is full of competing visions of how some kind of stable system might emerge. Pro-competition market liberals, oil companies, institutional liberalism OPECs, pro-integrationists, socialists, Moslem fundamentalists, pragmatic pluralists, and Cold Warriors of either side of the East-West conflict have contending visions of what kinds of world order should emerge in the area. It is toward the analysis of such competing visions of evolving interdependence that the present methodological framework has been developed.

CHAPTER III

METHODOLOGIES, MAXIMS, AND TECHNIQUES

by

Hayward R. Alker, Jr.

The present chapter will develop a number of methodological maxims for appraising various techniques of possible relevance to the analysis of evolving patterns of global interdependence. Once they have been put in their appropriate methodological context, a variety of social science techniques currently being used in international relations research will be critically reviewed in those terms. Anticipating the results of this review, it is reasonable to expect that the demanding questions raised by the structure-sensitive perspective of the previous chapter will not easily and wholly succumb to existing analytic techniques. Nor should we expect techniques to be more than pieces of more comprehensive methodologies associated with old or new analytical orientations to interdependence research. The more difficult and creative task of methodological innovation will be addressed in Chapter IV.

A. Methodological Maxims for Interdependence Research

Anyone familiar with the development of analytical techniques knows both that they have their origins in methodological orientations associated with particular clusters of analytical concerns and that their utility as intellectual products can be extended beyond their originating contexts if appropriate adaptations are possible.¹ Thus both the review

¹Public goods analysis, for example, derives from institutional liberalism, partly in response to Samuelson's proof that market equilibrium is inefficient for goods with consumption externalities. It has carefully been extended to the security field by Harrison Wagner, and to regional integration studies by Ruggie and others. And input-output analysis comes from Soviet Russia, but has been adapted to a liberal context by Leontieff, and is now being applied by him to North-South development-ecology tradeoff analysis.

of existing analytical techniques for their applicability to new problems, and the development of newer, more relevant techniques need careful attention to the special features, including methodological requirements, of the newer context.

As a definition of such a new context, I have taken the common analytical problems of the previous chapter, derived from attempts to answer questions raised in the interdependence controversies of Chapter II, Volume I, and the related issues of Volume II. A further specification of analytical orientation was advanced. In the previous chapter, I argued the relevance to interdependence issues of a historical systems approach to questions of world order design, emphasizing competing cross-state quasi-regime alternatives.²

Methodology is normative research philosophy: how one ought to study something.³ Methodologies are grounded in historically developing research communities, clusters of analytical concern, paradigm complexes, or what Kuhn now prefers to call disciplinary matrices.⁴ Methodological injunctions consist typically of positive and negative working heuristics for knowledge construction. Therefore an attractive way of articulating and concretizing the orientational emphasis of the previous chapter is to restate it in terms of methodological maxims-- heuristic injunctions relevant to interdependence research.

²Methodologically, I often find myself in agreement with Davis Bobrow's constructive critique of the World Order Models Project headed by Saul Mendlovitz. See Bobrow's "Transitions to Preferred World Futures: Some Design Considerations," 1974, unpublished. A somewhat similar alternative is William D. Coplin and Michael O'Leary, "A Policy Analysis Framework for Research, Education, and Policy-Making in International Relations," unpublished. Certain similarities with the Keohane-Nye post-functionalist orientation, as described in Volume I, should also be acknowledged.

³Except for his anti-social-science bias, I find Lakatos' late Popperian critical realism impressive on this and many related philosophical questions. See his "Falsification and the Methodology of Scientific Research Programmes," in Criticism and the Growth of Knowledge, ed. Imre Lakatos and A. Musgrave (Cambridge: Cambridge University Press, 1970), pp. 91-195.

⁴See Thomas Kuhn's introductory paper in Criticism and the Growth of Knowledge, ed. Lakatos and Musgrave.

We shall present twenty such maxims without claiming them to be exhaustive of, or exclusive to, the present methodological orientation. Since most of them are focused on what interdependence research should look at, their application to particular techniques will help determine relevance or nonrelevance more than adequacy or inadequacy. Adequacy judgments involve many more standards of normative appeal, judiciousness, contextual accuracy, goodness of fit or feasibility than one could hope to cover in a few pages. Nonetheless, the maxims have, as a whole, a fairly distinctive flavor to them, and should provide new insights at later stages of critical and constructive interdependence analysis.

Consistent with our choice of a world order design focus on interdependence issues, these maxims can be described as design research methodology. Herbert Simon suggests six topics comprising design research on artificial systems.⁵ They include, but go beyond, topics usually considered by "realists" who think of balance of power systems as somehow inevitable or "natural." Thus besides natural/social scientific theories of external environments, Simon includes within design research theories of internal environments, their objectives, motives, and internal constraints. And to the normal concern with policy alternatives he adds theories of alternative, artificial structures and their relative performance as interfaces between inner and outer environments. Finally, with the high degree of linguistic self-consciousness characteristic of modern methodologists, Simon goes beyond the normal concern with evaluating interface relations to study more abstract questions concerned with the representation of design problems and the choice of formal logics for description, design, and evaluation.

As should become clear, these topics can quite easily be adapted to the present concern with global interdependence. For completeness I suggest here a revised politicized version of this entire list, but present specific analytical maxims for only the four topics that are the most concrete.

⁵Herbert Simon, The Sciences of the Artificial (Cambridge: M. I. T. Press, 1969), p. 79f. and in the last chapter, entitled "The Architecture of Complexity."

Topic 1 The Representation of Interdependence Design Problems

Solutions to some problems are made easier and descriptions more forceful by changing the ways in which the problem is conceptualized. The emphasis on cross-state, quasi-regimes as core parts of interdependence systems assumes, in fact, a representation of policy flows and other transactions in and out of cross-state actors through regime-like interfaces.

Looking at Figure 1 suggests one such clue to the analytical problems of Chapter II. It suggests an important feature of both quasi-regimes and cross-state actors, their openness as systems. Open systems have determinative inputs from their environments. Such inputs combine with control attempts to generate the negative and positive feedbacks generating many of the unanticipated consequences noted by interdependence analysis. Making projections or predictions about open systems requires knowledge of their resource and information inputs, as well as other exchanges with their environments.

Figure 1 is also suggestive in policy terms. The most powerful reasons for structure-sensitive interdependence policy is not the utopian faith of unrealistic international lawyers but the temptation of nominally sovereign states to increase their predictive powers and independent self-control through unilaterally regulated (or vetoable) exchanges with external actors and natural environments. Thus the politically attractive but often unfeasible goal of closing an open system, redefined to include a cross-state actor and its associated regime interfaces, could be schematized in the figure by extending unilaterally controlled regime interfaces to regulate all inputs. Contending regime alternatives often represent just such designs by major cross-state actors.

Representational issues go beyond the question of how to schematize quasi-regimes in the economic, ecological and security areas. Useful, value-relevant conceptions of initial theoretical terms depend in part on ontological predilections, scholarly interests and practical utility. The interdependence analyst needs more and better ways of simultaneously considering and comparing multiple objectives subject to multiple constraints. One way of doing this is to develop formalisms simultaneously representing equity, coercion, and efficiency objectives. Consider, for example, Marx's respecification of Ricardian economics to include exploitation and equity concerns through the introduction of the concept of surplus labor value. Thurow's treatment of inequality as a Samuelsonian public good similarly suggests how distributional

questions can be treated within liberal political economy.⁶

The deeper nature of rationality, freedom, and autonomy has been explored in Deutschian cybernetics and Habermas' Marxian writings on communicative competence. They may make possible respecifications of mixed interest choice situations in ways facilitating resolutions of Prisoner's Dilemmas.⁷ Schelling's respecification of adversarial military relationships as sequential, mixed interest, tacitly coordinated two party games has already had some effects in political practice.⁸ Conceptual typologies of regulative principles, policy possibilities, and problem situations belong also in this topic. Such typologies will not be further pursued here, other than to note how Figure 1 highlights a variety of previously mentioned structure-sensitive policy options, including self, practice, regime, other and natural environmental transformations.

⁶Lester Thurow, "The Income Distribution as a Pure Public Good," Quarterly Journal of Economics, vol. 85, no. 2 (May 1971), pp. 327-36. The classic reference is Paul Samuelson, "The Pure Theory of Public Expenditure," Review of Economics and Statistics, vol. 36, no. 4 (November 1954), pp. 387-89. A key maxim of liberal theory is restricted but not totally denied by Thurow's approach: model choice processes in ways that are essentially voluntaristic, with ordinal measurement, not making interpersonal comparisons. The Marxian objection to these maxims strikes me as more realistic.

⁷Karl Deutsch, The Nerves of Government: Models of Political Communication and Control (New York: The Free Press of Glencoe, 1963); and Jürgen Habermas, Toward a Rational Society (Boston: Beacon Press, 1970). Relevant research on Prisoner's Dilemmas is being carried on by Walter Buckley, Tom Burns, and others.

⁸Thomas Schelling, The Strategy of Conflict (Cambridge: Harvard University Press, 1960).

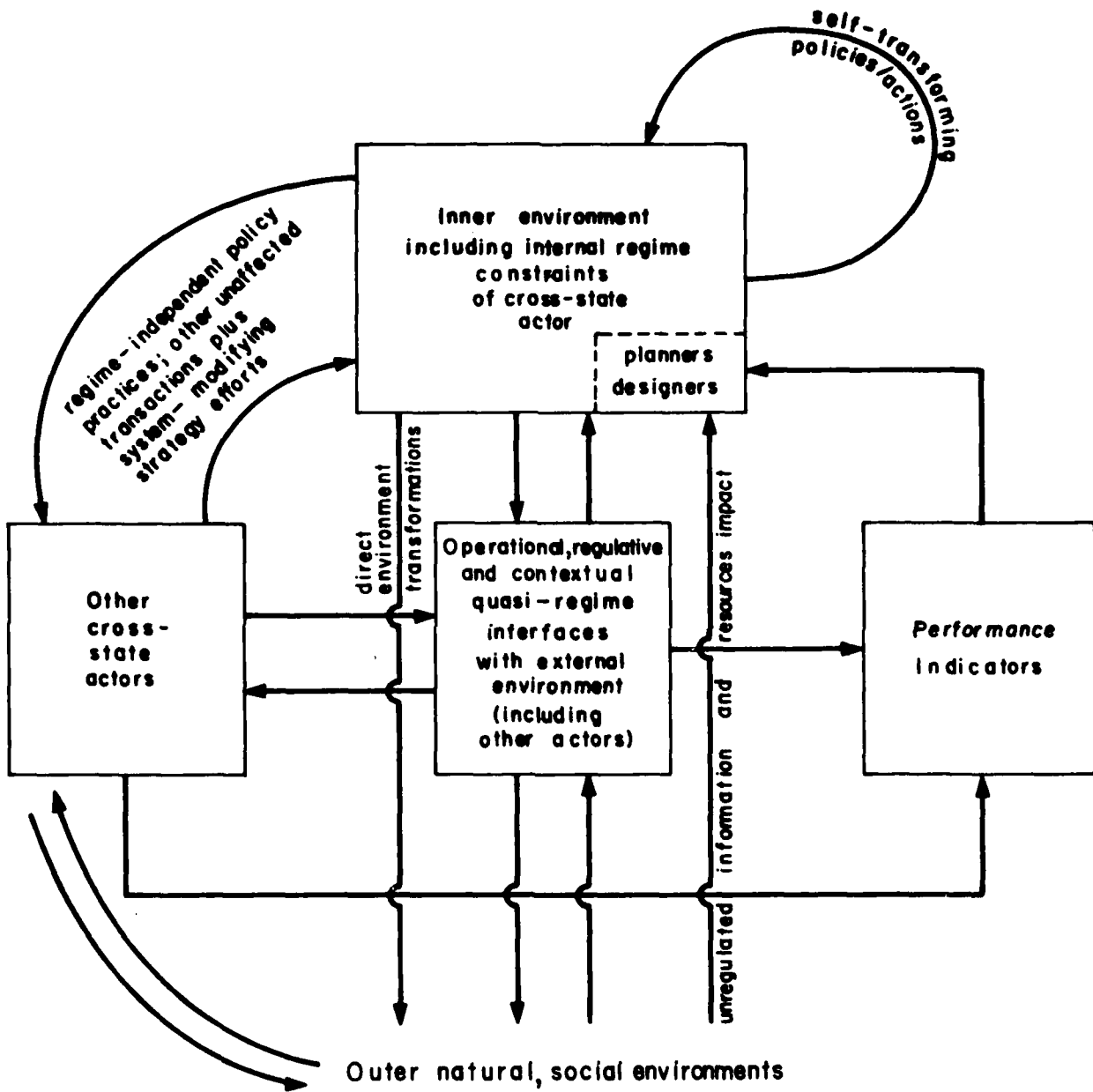


Figure 1. Cross-state actors and quasi-regimes are open systems

Topic 2 Theories of Natural and Social Environments

Maxim 1 Theoretical specifications (and hopefully models) should be made of the dynamics and transformability of natural and social environments external to contemplated regime participants.

The necessity of explicit external environment models follows immediately from the recognition that operating interdependence regimes, such as U.S.-U.S.S.R. crisis management, the Euro-dollar market, or off-shore fishing conventions are open systems. They are far from being powerful enough to close off the United States from external dependencies. Hence, independence (in a strong sense of completely autonomous self-control) is impossible, and future projections must go beyond those of the ceteris paribus sort which ignore environmental inputs. Simon makes this point by saying design constraints cannot be ignored. By these we mean here (nonmanipulable) theoretical principles governing the behavior of external environments, such as the autonomous actions of other cross-state actors, some macro-economic processes, and politically insulated demographic or ecological processes.

Even though the Forrester-Meadows models have many debatable assumptions, particularly concerning the nonmanipulable nature of linear technological adaptation to exponential growth, they must be singled out methodologically as highly relevant modelling efforts within the purview of the "natural" parts of this maxim. Seabed regulation discussions based on different treatments of differently migrating and reproducing fish populations also suggest differently designed regime possibilities.

Maxim 2 But because such environments are rarely accurately predictable, a probabilistic error treatment, using appropriately specified random variables, is desirable concerning parts of the environment not deterministically modelable.

Nonlinear processes respond differently to random inputs than linear processes; random inputs in the former case cannot be averaged out or ignored. This maxim is more technical than the first. It is grounded in a historical systems philosophy which does not see all social and natural processes as completely deterministic. Nuclear

the Bloomfield-Leiss-Beattie CASCON system.¹¹ A Marxist analysis would purely try to find the relevant class conflicts: post-functionalists should at least study relevant agenda processes.

Maxim 3 Ascertain actual and potential information and resource flows, including causal impacts from environments into major actors and actual or potential regimes.

Another concern derives from the recognition, emphasized by Figure 1, that most currently existing or contemplated regime constructs are open systems controlled by a multiplicity of similar participants. The interdependence analyst with a predictive interest should measure flows and impacts from external environments for both actual and contemplated regulatory systems. The unanticipated role of Eurodollars and Petrodollars in end-running the monetary restrictions of the Bretton Woods-IMF regime strikes me as a relevant example here. Conservationist objectives (talked about again below) cannot be defined, let alone achieved without the calculation of appropriate indicators. One of the problems of the World Dynamics modellers was their failure in their earlier work to make explicit regime alternatives. This absence makes it impossible to judge which types of flows or impacts would go where under various types of newer, collective environmental arrangements. Even Deutschean trade flow analyses allow the measurement of actual but not potential nonrandom Common Market concentrations in trading practices. Roll-call-oriented studies of differing alignments in international institutions on differing issues allow correlational links of roll calls and economic-political differences, but causal assessments require more precise data on what promises, threats, aid, and political supports do or might flow to and from whom

¹¹Lincoln P. Bloomfield and Robert Beattie, "Computers and Policy-Making: The Cascon Experiment," Journal of Conflict Resolution, vol. 15 (1971), pp. 33-46. A historical report on the development of the Alker-Christensen-Greenberg research, suggesting some of my own reasons for interest in design research, is Hayward R. Alker, Jr. and Cheryl Christensen, "From Causal Modelling to Artificial Intelligence: The Evolution of a UN Peace-Making Model," in Experimentation and Simulation in Political Science, ed. Jean LaPonce and Paul Smoker (Toronto: University of Toronto Press, 1972).

exchange models in the Ellsberg tradition⁹ go to the opposite extreme from the world dynamics models, in not specifying external crisis dynamics challenging a mutual assured destruction deterrence quasi-regime (which depends crucially for its stability on shared rationality rules), but they do treat their environments probabilistically. Work by Harsanyi, Selten, and Tietz,¹⁰ attempts to go a bit further in simultaneously being responsive to considerations suggested by both Maxims 1 and 2. It should be noted that many analysts would accept Maxim 2 in principle but contend that the present stage of their work is not ready for it.

One should hope such an excuse was relevant in his own work. In fact, earlier Alker-Christensen-Greenberg simulation models of the United Nations Collective Security quasi-regime did use Bayesian models of external environments. But, following too closely the pluralistic tradition of integration studies, these authors never modelled the causal dynamics of where their conflicts came from. Neither does

⁹See Douglas E. Hunter, "Some Aspects of a Decision-Making Model in Nuclear Deterrence Theory," Journal of Peace Research, vol. 9, no. 3 (1972), pp. 209-22.

¹⁰John Harsanyi, "A Simple Probabilistic Model of Nuclear Multipolarity"; Reinhard Selten and Reinhard Tietz, "Security Equilibria"; and Selten and Tietz, "A Formal Theory of Security Equilibria," in The Future of the International Strategic System, ed. Richard Rosecrance (San Francisco: Chandler Publishing Company, 1972).

on which occasions.¹²

Regarding environmental impacts, research by Choucri and North using econometric methods is a significant improvement, even if the particulars of the alignment process are not explained.¹³ They present explanations of armaments, territorial expansion and violence using, inter alia, environmental demographic, resource, and industrialization variables. Projections based on systems of probabilistically determinative equations, including internal bureaucratic pressures and external threats, often explain more than half of the variance in the aforementioned political variables. During the important system change associated with the end of the Bismarck era (c. 1892-1896), some, but not all, of the key causal relationships remained stable.

Maxim 4 Attention should be given to the potential often-unanticipated impacts or side effects of quasi-regime alternatives on natural environments and on social groups whose support is not necessary in the short run to sustain the inner structure of quasi-regime practices.

¹²These self-critical assessments are based on research methods that I have used. See Hayward R. Alker, Jr. and Donald Puchala, "Trends in Atlantic Partnership, 1928-1963," in Quantitative International Politics, ed. J. David Singer (New York: Free Press, 1968), and Hayward R. Alker, Jr., "Supranationalism in the United Nations," reprinted in International Politics and Foreign Policy: A Reader in Research and Theory, ed. James N. Rosenau (New York: The Free Press, 1969).

¹³Nazli Choucri and Robert North, Nations in Conflict (San Francisco: W. H. Freeman, in press). Although not yet accomplished, it is worth noting that Mesarovic-Pestel world model design goes beyond both the World Dynamics and Leontieff's efforts in meeting both parts of the injunctive Maxim 4. See Mihajlo Mesarovic and Edward Pestel, "A Goal-Seeking and Regionalized Model for Analyses of Critical World Relationships: The Conceptual Foundation," Kybernetes, vol. 1 (1972), pp. 79-85; and Barry Hughes, "Current Status of the Mesarovic-Pestel World Model Project," (Cleveland: Systems Research Center, Case Western Reserve University, 1974, unpublished).

Ecological impacts are value related and thus included here. Leontieff's extension of input-output analyses to a North-South case with environmental impacts and costs deserves mention here.¹⁴

This maxim also embodies the potentially valid insight of Marxist, radical-liberal, neo-functionalist, and conservative theoretical traditions that cross-state regimes depend for their sustenance on, and reward the support of, important transnational social groups. Not to obtain relevant data to test for these effects in particular cases is both bad regime planning and poor theory development.

Although transaction flow analyses do suggest nonrandom trends associated with Common Market arrangements, more sophisticated combinations of statistical techniques are necessary before such concentrations can be causally attributed to regime effect.¹⁵ In a similar fashion, it is hard without good causal theory to estimate effects of arms control agreements on what might have happened.

Maxim 5 distills a major point easily derivable from either the debate over Limits to Growth or the new political economy controversy, if not from common bureaucratic sense or methodological sophistication: don't trust expert findings concerning natural or social regime environments. Neither does it counsel despair; rather it concretizes our earlier emphasis on analyzing competing regime alternatives.

Maxim 5 The findings of scientific experts with different doctrinal/ value emphases must be examined, checked, and compared at least to the extent likely regime participants differ in their environmental assessments.

¹⁴Wassily Leontieff, Nobel lecture, Stockholm, 1973. The lecture reflects a larger, UN-based project.

¹⁵Important steps in this direction have been taken by Krause and Linnemann, among others. See Lawrence Krause, European Economic Integration and the United States (Washington, D. C.: The Brookings Institution, 1968); and Hans Linnemann, An Econometric Study of International Trade Flows (Amsterdam: North Holland Publishing Company, 1966).

One technique is rarely sufficient for this purpose: different scholarly orientations often differentially stress different methods of empirical assessment. Modified Delphi methods, were they extendible to issues on which scholars with different paradigmatic orientations did not converge in their prognostications, would help in this regard.¹⁶ But entirely independent studies by groups known to have different orientations are often worth encouraging.

Topic 3 Theoretical Analyses of Interdependence Practices
(Including Internal Environments and Regime Capabilities)

Maxim 6 Actor-relevant time-specific actions, sensitivity effects, resource costs, outcome trade-offs, and policy opportunity-costs should be routinely part of analyses of interdependence practices.

Maxim 7 Policy analyses should, moreover, be structure sensitive, making explicit estimates of the relevant impacts of external environments, internal organizational constraints, policies, and cross-state quasi-regimes.

Maxim 8 The appropriate multiplicity of cross-state actors should be studied.

¹⁶Delphi methods rely on repeated panels of expert judgments or forecasts to build a kind of technocratic consensus. For a recent application, see Fred Roberts' contribution in The Structure of Decision, ed. Robert Axelrod (forthcoming); and the extensive RAND literature. Summarizing a critical review, done with "Models, Simulations, Games (MSGs)," Garry Brewer notes that over two-thirds of such activity is all-machine technical or force structure analysis. Half of 132 MSGs had not been subjected to external review, 35% could not easily be transferred and replicated elsewhere, most professionals felt competent reviews would be "harmful." "Summary Report of a Survey of Models, Simulations, and Games," P-5177 (Santa Monica: Rand Corporation, 1974), especially p. 12.

Just as historically grounded theories of external environments help us think about possible regime developments or impacts, so formal, empirical theories of interface practices allow us to assess the relative impacts of regularized relationships and the far more pervasive unregulated policy actions of Figure 1. Maxim 7 goes beyond Maxim 6 and spells out the multiple levels of causation tentatively identified as common concerns in interdependence controversies, energy politics, and cross-state systems thinking. These maxims are responsive to the growing complexities facing the interdependence analyst. The relatively objective categories of Maxim 6 will be further supplemented by the subjective ones in Maxim 9 below.

At this point it is worth emphasizing how much of empirical research on international relations is centered on measuring interaction patterns without adding sensitivity effects, subjective data, cost or trade-off information (all often hard to obtain). If empirical research techniques--particularly events data analyses by McClelland, Rummel, Burgess Azar, and others¹⁷--are weak on these extra dimensions, how much stronger can policy analysis be at making the difficult causal assessments implied by Maxim 7? Public descriptions of PARA, for example, do not sort out relative impacts in self-conscious manner.¹⁸

¹⁷Recent relevant summaries and critiques are: Edward Azar, Richard Brody, and Charles McClelland, International Events Interaction Analysis: Some Research Considerations (Beverly Hills: A Sage Professional Paper, 1972), vol. 1.02-001; and Philip Burgess and Raymond Lawton, Indicators of International Behavior: An Assessment of Events Data Research (Beverly Hills: A Sage Professional Paper, 1972), vol. 1.02-010. One particularly good piece of work of direct relevance here, going beyond the limitations of particular coding techniques, is Azar's "Analyses of International Events," Peace Research Reviews 4 (November 1970), which links events data to the rise and fall of Egyptian-Syrian integration. The CREON studies currently in progress at Ohio State also show considerable structure-sensitivity in their research design, but have not yet been fully reported.

¹⁸PARA: Process, Problems and Potential (Ann Arbor: Social Science Department, Bendix Aerospace Systems Division, July 1972), chapter 2.

Of course, complex, multilevel statistical models are necessary for simultaneously assessing multiple effects. In this regard the Choucri-North analysis of the 1870-1914 period and the Mesarovic-Pestel World Model are quite unusual. The Choucri-North model allows quantitative assessments of alliance impacts, policy actions, domestic bureaucratic inertia, environmental pressures, and (as residuals or breakpoints) the effects of Bismarck-type system strategies.¹⁹ The fact that ten years' work went into collecting relevant attribute and event data and developing the appropriate, still tentative econometric models for the Choucri-North book gives an idea of the work involved in taking Maxim 7 seriously.

The Mesarovic-Pestel model also contains some particularly impressive impact assessment possibilities, joined with a rather rich, interactive policy analysis routine showing alternate effects, trade-offs, and opportunity costs associated with different policy options. Unanticipated consequences in environmental or security dependencies do occur because of the cross-sector nature of model interdependencies. Table 1 shows simulated decision-making by a regional group of developed market countries. Note how forecasts and alternative policies and more specific implementation strategies can all be explored for their implications. Global and regional lack of aggregation are possible and within each environment-linked norm structure, policy planners, policy choosers, decision structures, and natural-social causal environments are separately represented, allowing multi-level impact studies. Hughes, for example, has shown (assuming valid economic models, which are in fact rather simplified at the present stage and only partially tested econometrically) how perceived threats to energy supply could affect, at the normative level, developed market investment figures by \$20 billion or more per year, with considerable unanticipated growth reduction effects. As in Table 1, instrument-objective constraints are also suggested by this example. Newer institutional tools are obviously called for, as well as new ways of defining a smaller number of overarching objectives.

¹⁹Choucri and North, Nations in Conflict, Part IV. Also important is a statistical study by R. Codoni, B. Fritsch et al., World Trade Flows, Integrational Structure and Conditional Forecasts, 2 vols. (Zürich: Schulthess Polygraphischer Verlag, AG., 1971). Contingent forecasts by Fritsch project increasing North-South inequalities in export earnings as LDC GNPs increase.

Table 1 on reverse page.

Table 1. An Illustration of Interactive Multilevel Policy Analysis Using the Mesarovic-Pestel Economic-Energy Submodel*

Computer Model of Natural and Organizational (Including Economic-Energy) Environments

Human Decision Maker as Planner/Forecaster/Policy Implementor

Step 1: Potential current problems sought.

Step 2: Computer lists: import scarcity, resource scarcity cost.

Step 3: Additional information on anticipated problems sought.

Step 4: Simulation projects energy production cost increases and forecasts estimated impacts of different increases in regional energy production, consumption, import levels for 1 to 10 years.

Step 5: Relevant policy alternatives sought.

Step 6: Computer lists: increased imports, increased production from investment increases or shifts, mixed import/investment policies.

Step 7: Investment shift judged promising: explanation sought.

Step 8: Without total investment increase, shifts from industry or service sectors (via oil depletion or other tax benefits) are mentioned.

Steps 9 - 11: Another policy explored, non-import-increasing investment shift tentatively chosen.

Step 12: Computer notes that shift from industry and services slows down economic growth, which in turn relaxes demand for energy.

Table 1 (continued)

Step 13: Shift option chosen.

Steps 14 - 17: Different percent shift from industry, with different trade effects explored, 30% cut in industrial investment chosen.

Steps 18 - 20: Impact of \$20.5 billion shift is calculated on 1 to 10 year projections of consumption, production, and trade balances and displayed.

*Derived from M. Mesarovic, E. Pestel, B. Hughes, et al., "An Interactive Decision Stratum for the Multilevel World Model" (Hannover Technical University, 1973, unpublished). The analysis is for the "region" of developed market economies.

It will be recalled that Chapter II built up to the analysis of utility interdependencies on the basis of earlier sensitivity interdependencies, possibly evaluated in very different ways. The case for a regimes emphasis within an order building focus depended heavily on increasing recognitions of possibly securable mutual advantages, often of a public sort, especially in the case where utilities were configured like those of the Prisoner's Dilemma. Such a dilemma is the case par excellence where independent interest-maximizing cross-state actors are self-defeating. Important aspects of each controversy of Chapter II, Volume I, fitted this analytical problem.

The next step in analyzing interdependence practices, then, is the delineation of the preferences, perspectives, and utilities of causally relevant cross-state actors in order to see which forms of interdependent relationships might develop. The level of analysis problem of interdependence controversies suggests a rich research net if key determinative and regulative issues are not to be decided by fiat. Both central governmental, loosely coordinated transgovernmental and transnational actors continually reappear in the literatures we have reviewed, including the energy case.

Maxim 9 The subjective interests, preferences, identities, and expectations of such actors should be researched, including their assessments of alternative interface arrangements (including various regime possibilities).

Bluntly put, how can we design cooperative economic strategies or conservation regimes with communist states if we do not know their appraisals of such relationships?

A cluster of new techniques has recently come into the international relations field directed toward the achievement of these difficult objectives. It is a kind of third generation content analysis linked to cognitive processing simulations. Axelrod, Bonham, Hart, and Shapiro are the leading practitioners of a school that includes more established scholars like Ole Holsti and Alexander George at its fringes.²⁰

²⁰Unfortunately, the two best summary volumes, The Structure of Decision, ed. Robert Axelrod, and another volume edited by Mathew Bonham and Michael Shapiro are not yet published. Many relevant papers are available as preprints, however. And the next generation of cognitive process models is already on the horizon. See Robert Abelson, "The Structure of Belief Systems," in Computer Models of Thought and Language, ed. Roger Shank and Kenneth Colby (San Francisco: W. H. Freeman, 1974).

These scholars have developed a fairly reliable (but probably less valid) way of coding extensive interview material or documentary evidence for qualitative causal maps of cognitive beliefs, including environmental impacts and policy effect on decision-maker utilities. Bonham and Shapiro,²¹ for example, found a Middle East expert whose views of the politics of the area were used to derive policy actions which corresponded rather closely with subsequent United States government actions in the area. The problem of obtaining relevant data on key decision-makers here and abroad cannot be overlooked, however. Nonetheless, Jeffrey Hart²² and others have been able to use judgmental, roll call, and public debate information to estimate diverging/converging alignments and perceived objective compatibilities associated with different policies and regime alternatives in the oceans area.

At least a few words should be said how these qualitative cognitive mapping approaches deal with instruments-objectives constraints and unanticipated consequences problems. Because we would expect law of the seas discussions to have many cross-sector issues and trade-offs--security, development, redistribution, and conservation are obviously involved--we should expect incompatible objectives and unanticipated side-effects to occur. They do, and can be represented but are not always resolvable in cognitive maps. Simple policy dilemmas are sometimes resolved by finding other instruments without the unanticipated negative side-effects. Coalition politics across regions is, in Hart's case, a likely lubricant producing some cross-objective compensations, but it is also likely to produce other unanticipated complications in whatever oceans regime that actually develops. Until cognitive mapping and related simulation approaches allow the reduction of objectives and the artificial creation of new policy instrumentalities--such as Hammarskjöld's end-run around British and French vetoes in the Suez crisis--they will not overcome these considerable problems.

²¹Michael J. Shapiro and G. Matthew Bonham, "Cognitive Process and Foreign Policy Decision-Making," International Studies Quarterly, vol. 17, no. 2 (June 1973), pp. 147-74.

²²Hart's relevant paper is in the Axelrod volume. A more explicit statistical study using public international organization roll calls and speeches is Robert Friedheim and Joseph Kadane, "Ocean Science and the UN Political Arena," Journal of Maritime Law and Commerce, vol. 3, no. 3 (April 1972), pp. 473-502.

Maxim 10 Judgments of actual (or hypothetical) system functions should be supplemented, wherever appropriate, by explicit theoretical statements of operational rule structures and capability-loads analyses of them.

This maxim puts a hard test before the analyst of interdependence practices. It spells out the multilevel regime emphasis of the previous chapter designed to deal with mixed interest coordination problems. It says to look first at actual (and, perhaps later, hypothetical) practices to see if somehow they are systematically describable. Then, to the extent possible, it suggests finding shared, more or less explicit, consensual regulative system functions, ground rules, or operational rule structures underlying or accounting for such regularities. But more is necessary than exhibiting the structural bases of partial procedural or substantive regime structures. Their capability for handling various loads--system crises, problems, or demands--should then be assessed.

Why raise such questions? Because the piecemeal, disjointed nature of much contemporary order-building practice is clearly related to differing perceptions of the capabilities of various institutionalized practices (or quasi-regimes) for handling various issues. Both Marxists and integrationists stress the importance of crisis/demand overload for the breakdown and transformation of various socio-economic and political systems. The security of deterrence and the strength of crisis management practices rest on assumptions about the adequacy of shared behavioral codes, whose limited capabilities need continuous review according to behavioral peace researchers. Market-oriented liberals and balance of power realists both laud the adaptive, hidden hand capabilities of their preferred systems; others criticize these systems as terribly inadequate for achieving either welfare or security goals. Resolving these substantive issues is part of the policy-maker's problems in deciding which claims for reform-oriented interdependence policies or systems strategies he should take seriously.

Just as William Riker has shown the logical inconsistency of one reading of Kaplan's Balance of Power System Rules,²³ so less elegant studies of collective security regimes have shown early pious expectations about UN capabilities in this area predictably to have been over-

²³William H. Riker, The Theory of Political Coalitions (New Haven: Yale University Press, 1962).

rated.²⁴ Barry Hughes' previously cited explorations of different norm structures for developed market economies presage a similar kind of regime analysis in the Mesarovic-Pestel economic-energy context. Both actual and hypothetical alternatives were explored. Concerning the future, the interdependence analyst needs to know which rules are likely to be operative in what contexts, with what effects, before one can knowledgeably support or condemn feasible alternative regimes.

An historical systems approach makes further demands. Until the development of memory-rich artificial intelligence simulations, such as chess-playing programs, traditionalists were always potentially right in asking behavioralists about the role of history in the processes being observed and modelled. Something more than statistical averaging over one or two previous time periods was necessary, if innovative rather than inertial bureaucratic processes were to be understood. Most statistical analysis (including Choucri-North econometric models, Forrester-Meadows models, and especially game-theoretic deterrence models) summarize the past very parsimoniously, ignoring what both lawyers and realists call precedents. Behavioral peace researchers have usually preferred equally ahistorical statistical models of past effects and have often succeeded scientifically by omitting a lot of relevant contexts from their experimental set-ups. Hence Maxim 11 goes more than one ox:

Maxim 11 Memory-rich specifications of quasi-regimes are to be preferred over ahistorical ones because the performance, reproduction, and self-transformation of historical systems depend importantly on memory processing capacities.

²⁴See Hayward R. Alker, Jr., and William Greenberg, "Analyzing Collective Security Regime Alternative," to appear in the Bonham-Shapiro volume. Capabilities in this case were assessed in terms of batting averages or integrals taken over hypothetical conflict environments. A more powerful version of this methodology, going more deeply into the modern cybernetics literature, is Hayward R. Alker, Jr., "Political Capabilities in a Schedule Sense: Measuring Power, Integration and Development" in Mathematical Approaches to Politics, ed. Hayward R. Alker, Jr., Karl Deutsch, and Antoine Stoetzel (New York: Elsevier, 1973).

Of the analytical tools we have looked at, only the Alker-Greenberg paper, CASCON, and parts of the cognitive maps literature have moved much in this direction. Mesarovic-Pestel analysis also allows the nonsimulated decision-maker to use his own memory as a problem solver and even helps him refresh it, but does not go into CASCON-type precedent "searches" in the design of the normative level of their fully computerized multilevel simulations.

This maxim has an elitist, high-technology pedigree: most modellers cannot easily live up to such standards because they cannot conceive or afford relevant list-processing simulations. But it does help emphasize the importance of human role players--or memory banks--in man-machine simulations or more traditional all-human political military exercises. Innovative policy thinking, restructuring given instruments and objectives to make hard choices, is very hard to program on a computer.²⁵

Topic 4 Logics for Prescribing/Describing Interdependence Designs

Given the normative quality of regimes themselves, and debates about preferred alternatives, an abstract subject with both classical and contemporary relevance is the comparison of descriptive and prescriptive logics. Practical politicians have always used rhetoric, persuasion and propaganda to advantage. At a higher order of methodological discussion is the utility of various rationality logics, including variants of choice theory and cost/benefit analysis for making political arguments. Marxian-liberal conceptual debates about labor value theories belong here too.

Even more abstractly, Simon, other philosophers, and computer semanticists are studying the necessary properties of alternative formal language systems for articulating plans, deriving normative implications of general rules or standards, or articulating analogical reasoning

²⁵The most recent experimentation in professional-level all-human political games (POLEX) at M.I.T. made explicit a number of analytical features including the historical and processual models supplied via use of experienced game participants. See Lincoln P. Bloomfield and Cornelius J. Gearin, "Games Foreign Policy Experts Play: The Political Exercise Comes of Age," Orbis, vol. 16, no. 4 (Winter 1973), particularly p. 1028.

so important to precedent-based policy inferences from historically rich data sources. The need to mesh statistical evidence and judgmental data in planning crisis-relevant information systems illustrates how these concerns can have practical consequences.²⁶ But we shall not follow them further here.

Topic 5 The Search for Successful Interdependence Policies

What are the cumulative "lessons" of American-Soviet confrontations, as they have modified operating procedures and substantive agreements in subsequent crises--the core structure of the "crisis management" quasi-regime on which we depend for our lives? Why did Vietnam "disengagement" take so long? More immediately, what were the old and new elements of the Israeli-Egyptian situation, how were they combined, with what sequencing, why successful in Secretary of State Kissinger's truce negotiation effort? Could other feasible regimes have been previously conceived? Were they? What mix of desirable objectives did they achieve in economic, communal, ecological, and military terms? How did they mesh with routine policy considerations? Were instrument-objective constraints somehow overcome? Which of the many imaginative policy options mentioned in Volume I should the United States pursue, in what order, on what issues?

Simon argues that design solutions are action sequences leading from present to possible worlds satisfying internal and external constraints. It is clear that regime-innovative statesmen must work in similarly complex ways, even though the relevant considerations of systems strategy are rarely made public with alacrity. Systematic policy searching surely also involves imagining alternative regime prospects and multiple objectives, including those currently or previously contending for cross-state support. Modest revisions of old regime types often have strong appeal because of their greater

²⁶I again have in mind here systems like the Bloomfield-Beattie CASCON system, which interactively allows the experimenter to make many of the judgments of likely effects of conflict resolution measures in an emerging conflict situation, but which gives him a rich data base of measures relevant to "similar" previous cases, including scholarly postmortem judgments.

familiarity, enabling actors to calculate likely outcomes using historical experience as precedents, yet some solutions require a great many necessary conditions to become sufficiently effective. Figure 1 helped typologize the many relevant possibilities of reform.

Learning from order-building efforts, from historical deterrence/compellance actions, or from political-military games how to institutionalize and enhance relevant conflict resolution capabilities requires the identification of successful staging heuristics, plus explicit post-mortems on both time-specific successes and failures.²⁷ To the extent that confidentiality allows, public criticism, as well as adversarial scientific critiques, are necessary to ensure genuine evolution in such regime-building practices. Such methods may differ in degrees of formalization from the problem factorization techniques and means-ends methodologies by Simon, but their ends are very similar. All of these concerns and injunctions are responses to the increasing complexities facing the interdependence analyst.

One can summarize these points more forcefully as follows.

- Maxim 12 More than one interdependence design or "possible world" should be considered (hopefully varying in terms of key objectives and values summarized in Maxims 6 and 7.) Otherwise system restructuring strategies are operationally meaningless.
- Maxim 13 Historical practices, including precedents, should be used for the (re)design of the multiple alternatives noted above.
- Maxim 14 Sequentially explicit construction heuristics (design principles) must be explicated; otherwise their operational meaning remains obscure.

²⁷International relations research is rather behind in its use of such techniques. Forrester students and Mesarovic-Pestel coworkers have considered and used some of them. Bobrow's "Transitions to Preferred World Futures" is especially good in discussion of Falk-Mendlowitz "future" projections in these terms. See also Alker, "Political Capabilities in a Schedule Sense."

Maxim 15 Feasibility arguments about a regime alternative should spell out and make plausible the attainability of necessary and/or sufficient conditions for each order-building stage.

Maxim 16 Explicated regime construction or redesign principles must be scientifically and prescriptively subject to post-mortem analyses; otherwise statesmanship can never be a cumulative science of design.

Topic 6 The Evaluation of Cross-State Interdependence

Simon emphasizes the relevance of conventional utility theory techniques, optimal control algorithms and artificially intelligent heuristics as ways of evaluating engineering designs. Political architecture may be more difficult consensually and perceptively to assess.

Surely one of the clearest messages of this report is the need to look at structural (including regime) alternatives. From this follows the need to evaluate current or hypothetical interdependence structures in terms of the value differences at the heart of the issues we have looked at. Maxim 17 summarizes our discussion of these, as follows.

Maxim 17 Interdependence relationships, including regimes and less consensual structures, should, at a minimum, be analyzed for the efficiency, equity, autonomy, capacity, modernization, and conservation objectives meaningful to potential participants in such relationships.

The centrality of such concerns at this point should require no further argument. Vernon's 1972 analysis on this point suggests such an awareness even if its prescriptions might not be attractive or historically valid in the light of subsequent developments.

The oil-producing countries have come to be the senior partners, in effect, in the world oil oligopoly. To the extent that "order" exists in the market, it is maintained mainly by the vertical integration of the oil companies, supplemented by the elaborate network of relationships between

them, and shored up by the official United States system of proration and import controls. To the extent that benefits derive from such order, they are shared by the producing countries; indeed, by now, the lion's share of these benefits goes to the producing countries.

. . . It may be that developing countries are bound to feel a sense of vulnerability to world markets irrespective of their policies toward multinational enterprises. . . . The issue, therefore, may be to find an acceptable form of dependence, one that is not more threatening than necessary to the sense of control required on the part of the national leadership.²⁸

Vernon's judgmental, historical, and incomplete statistical studies of the effects of joint ventures on investment and growth point toward other evaluative standards of relevance more broadly in interdependence analyses, even if it ignores possibilities of revolutionary transformations in domestic social structures.

Maxim 18 Moreover, political and economic evaluations should be extended to include the opportunity costs for relevant actors of regime alternatives, not just the opportunity costs of normal policy alternatives mentioned in Maxim 6.

Maxim 19 As part of the scientific contribution to such discussions, an appropriate mix of judgmental, rational, and complex causal assessments should repeatedly be used in order to ensure relatively comprehensive quasi-regime evaluations in changing conditions of historical interdependence.²⁹

²⁸Raymond Vernon, The Operations of Multinational United States Enterprises in Developing Countries: Their Role in Trade and Development (New York and Geneva: United Nations Conference on Trade and Development, 1972), pp. 6 and 26. See also his impressively thorough but often judgmental "Multinational Enterprises in Developing Countries: An Analysis of National Goals and National Policies," draft prepared for United Nations Industrial Development Organization, 1974.

²⁹This maxim is also in part responsive to work by William Coplin, Michael O'Leary, and others, at Syracuse University, who argue the increased relevance to foreign policy analysis of judgmental techniques. For several reasons I agree, but would supplement such judgments as indicated.

The problem of really joining debate over his arguments comes from a deeper aspect of the liberal-radical divide. Marxists are sometimes willing to accept his arguments about net capital outflows from Latin America, the benefits to industrialized labor, and "efficient" world GNP enhancement of such relationships and the decreasing structural opportunity costs of nationalization in some cases. But they object at a deeper level to the ways such evaluations are framed and socialist alternatives ignored.

Emmanuel's equally eclectic and analytically fascinating study of pre-1960 trading practices evaluates many of the same trends Vernon observes, in terms of the degree of coercive exploitation interest in capitalistically organized transnational trade relationships between industrially advanced and economically backward countries.³⁰ The increasing gap between developed and underdeveloped countries, and between centers and peripheries in underdeveloped countries, an equity issue largely ignored by Vernon, is highlighted.

Both positions might need re-evaluation, however, in the light of certain structural transformations taking place in global resource markets. Serious efforts such as those by Thurow and Ruggie to extend public goods analyses to include systems evaluations and equity issues are also necessary for real communication on these points.³¹ Such cross-paradigm communication is extraordinarily difficult, yet more necessary with, across, and between nations that are increasingly, if often still asymmetrically, interdependent. Hence:

Maxim 20 Public debate and cross-paradigm adversarial science are necessary for the discovery of latent system functions (such as inequity perpetuation) and the definition of quasi-regime objectives susceptible to legitimate institutionalization.

³⁰ Arghiri Emmanuel, Unequal Exchange: A Study of the Imperialism of Trade (New York: Monthly Review Press, 1972).

³¹ The reader will recall relevant discussions in my previous chapters.

TABLE 2. Possible Techniques for Interdependence Research: A Tentative Relevance Scorecard

Issue Area and Research Techniques	Methodological Maxims																				Box Score
	Models of external environments	Their probabilistic treatment	Measure flows and impacts from environment	Assess regime environment	Assess regime environmental side-effects	Competitive environmental assessments	Objective, multifaceted policy analyses	Multilevel structure sensitivity	Appropriate multiplicity of cross-state actors	Their policy perspectives, including regime alternatives	Analyze functions, rules, capabilities	Memory-rich regime specifications	Multiple interdependence designs	Using historical precedents	Sequentially explicit construction heuristics	Sequential conditions for feasibility	Post-mortems on construction heuristics	Efficiency, equity, autonomy, etc., evaluations	Regime alternative opportunity costs	Good mix of judgmental, rational, causal analyses	Adversarial assessment of quasi-regime alternatives
Security Issue Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1. Elleberg-Hunter (game model)	X	C	X	C	X	C	X	C	C	C	C	X	X	--	--						
2. Harsanyi-Selten (game model)	C	C	C	X	X	C	C	C	C	C	C	X	C	X	X	X	X	C	C	C	X
3. Riker-Kaplan (coalition theory)	C	X	X	X	X	C	X	--	C	C	C	C	C	C	C	C	C	C	X	C	X
4. Brewer (technical MSGs)	C	X	C	X	X	C	X	X	X	X	C	C	C	C	C	C	X	X	X	X	X
5. Choucri-North (econometric, events data)	C	C	C	C	C	X	C	C	C	C	X	C	C	C	X	X	X	C	X	C	X
6. Axelrod-Bonham-Shapiro (simulation, etc.)	C	X	C	X	C	C	X	C	C	C	X	C	C	C	C	C	X	C	X	C	X
7. Alker-Christensen-Greenberg (simulation, etc.)	X	X	C	C	X	C	C	C	X	C	C	C	C	C	C	X	X	C	C	C	X
8. Bloomfield-Beattie (simulation, etc.)	X	X	C	X	C	C	X	C	C	C	X	X	X	C	C	C	C	C	X	C	X
9. Political Military Exercise (game)	C	X	C	C	X	C	X	C	C	C	C	C	C	C	C	C	C	X	C	C	C
Ecology-Technology Area																					
1. Forrester-Meadows (simulation)	C	X	C	X	X	C	X	X	X	X	C	C	C	C	X	C	C	C	C	C	X
2. Hart on Law of Seas (data analysis)	X	X	C	C	C	C	C	C	C	C	C	X	C	C	X	C	X	C	X	C	C
3. Friedheim-Kadane (data analysis)	X	X	X	--	X	C	X	C	C	X	--	X	--	--	--	--	--	X	X	C	C
4. Roberts (Delphi panel judgments)	C	X	C	C	C	C	X	--	C	C	C	X	X	C	X	C	X	C	X	C	X

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<u>Political Economy Area</u>																				
1. <u>Vernon (mixed, informal)</u>	C	X	C	C	C	X	X	C	C	C	X	C	C	X	C	C	X	C	C	C
2. <u>Ermannuel (Marxian tableaux)</u>	C	X	C	C	C	C	C	C	X	X	X	C	C	C	X	X	C	C	C	C
3. <u>Ruggie-Thurrow (public goods econometrics)</u>	C	X	C	C	C	C	C	C	C	C	X	C	C	C	X	X	C	X	C	X
<u>Cross-Issues, including Energy</u>																				
1. <u>Leontieff (input-output analysis)</u>	C	C	C	C	C	C	C	C	X	C	X	C	C	X	X	X	C	C	C	C
2. <u>PARA (judgmental)</u>	C	X	C	X	X	C	C	C	C	C	C	C	X	X	X	X	C	C	X	X
3. <u>Mesarovic-Pestel (econometrics, simulation)</u>	C	C	C	C	C	C	C	C	X	C	X	C	C	C	X	X	C	C	C	C
<u>Integration Area</u>																				
1. <u>Alker-Puchala (RAAs, %s)</u>	X	C	C	X	X	X	C	C	X	X	X	--	--	--	--	--	C	X	C	C
2. <u>Codoni et al. (econometrics)</u>	C	C	C	C	C	C	C	C	X	X	C	C	C	X	X	X	C	C	C	C
3. <u>Alker Sopranationalism (content analysis, statistics)</u>	X	C	C	X	X	C	C	C	C	C	X	C	X	X	X	X	C	X	C	C

Key:

- C = Consideration given
- C = Partial consideration given
- X = No consideration given
- = Not relevant or feasible

B. A Provisional Review of Research Technique Relevance to Interdependence Analysis

With apologies to Professor Brzezinski, Table 2 leads to a relevance box score for the analytical techniques and orientations we have so far discussed. Adequacy issues are not addressed. The judgments given there have not been replicated by other methodologists; nor are they intended to extend beyond the context defined in terms of analytical problems common to interdependence issues. The judgments are ceteris paribus judgments, usually limited to particular uses of particular techniques, and within the limited research focus of their cited authors, rather than reviews of a technique in and of itself. It is with some reluctance that I apply all the maxims to each particular technical use--a technique is not bad if it doesn't do everything at once. But a provisional justification for doing so is the difficulty I have in knowing when the questions and processes analyzed by other scholars can be held in abeyance while the problems of a particular study are being addressed.

Several conclusions emerge from the table summary. First of all, most techniques do not satisfy most maxims of relevance, let alone the harder tests of adequacy one might want to impose. Behaviorists should be cautioned, therefore, about rushing into interdependence debates with poorly adapted tools. But the opposite conclusion limits the traditionalists' skepticism concerning social science research capabilities. There are techniques in existence that move toward meeting almost any one of the maxims of relevance our analytical context has suggested. And more recent approaches are sometimes more comprehensive.

The real inconclusiveness of this finding, however, follows from a third concluding observation. We do not have a good idea how well we can put together the substantive conclusions derived from piecemeal studies of multisectoral phenomena about which scholars from many different disciplines are asking often difficult analytical questions. Briefly, we don't know how factorable interdependence issues really are. The single most impressive technique for simultaneously addressing the issues we have looked at, the Mesarovic-Pestel world model, does, however, suggest a way of implementing a synthetic analytical design, at least within the economy-energy area.

Again the conclusion also emerges: the present project is somewhat misnamed. Hence we call our report Analyzing Global Interdependence rather than the overspecific yet indeterminate title "Techniques

for Analyzing Global Interdependence." One can far better assess the relevance to interdependence analysis of particular research programs and associated multi-technique methodological orientations like the Mesarovic-Pestel simulation-econometrics effort, or Kaplan's systems analyses. Other multi-technique analytical orientations are Cooper's mode of institutional economics, Marxist political economy, cognitive mapping research, and the Chourcri-North usage of econometrics and events-data techniques. Techniques are content free and theoretically applicable to almost any context that acquiesces to their imposition. It is the guiding research programs or methodological orientations, such as the world order design interest or Forrester's philosophy of systems dynamics that needs discussion, not per se the techniques of alternate future scenarios or Dynamo simulation that are most appropriate to assess.

The quality, relevance, and adequacy of a particular simulation far outweighs the question of whether or not simulation per se should be employed. The summary table is full of such ambiguities. Should we castigate integration studies because RA analysis is weak? Vernon's papers are obviously very relevant to dependency debates even though one would be hard pressed to describe his mixed approach in terms of one or two specific analytical techniques: liberal political economic analyses seem the more appropriate methodological label. Is his use of historical evidence a technique? Are not the values he talks about, or avoids, as crucial to the choice of technique as the capabilities of the technique per se? Differences in research programs need to be highlighted for choice purposes in this case.

We are thus led to suggest that policy-value-interest-linked research programs and associated methodological research designs are the appropriate units for discussions of how ought one to analyze evolving patterns of global interdependence. The maxims of the present chapter are in fact derived from a partially synthetic methodological framework designed to catch as many of the key concerns and analytical problems in the interdependence literature as possible: hence our focus on a historical systems approach to world order design questions, emphasizing competing cross-state quasi-regime alternatives. Chapter IV will go further in suggesting how such a focus and its derivative maxims apply to particular research areas, such as international commodity flows.

CHAPTER IV

METHODOLOGICAL CONCLUSIONS AND RECOMMENDATIONS

by

Hayward R. Alker, Jr. and Nazli Choucri

This chapter will attempt to restate the principal conceptual and methodological findings in the analyses of Volumes II and III and to make recommendations in a way in which action can be taken on them. First, we present our conclusions regarding the analytical meanings of the term "interdependence." In so doing we present some important distinctions which, if regularly used, would greatly clarify the semantic confusions ably highlighted in Chapter I, Volume I. Second, we recapitulate the appropriate methodological maxims of Chapter III as a basis for suggesting how future analyses of interdependence might be undertaken. Such analyses represent the natural extension of the exchange and transaction orientation of the energy interdependence study of Volume II of this report. They could be applied to any issue area involving actual or potential transactions among nations, to strategic as well as nonstrategic minerals, and to science and technology transfers. Our discussion presupposes the previous chapters' discussions of different types of cross-state actors and their quasi-regime relationships, as well as their rationale for the methodological maxims that we recommend be applied in future research on global interdependence.

A. Six Analytical Meanings of Interdependence

One major conclusion from our empirical investigations in Volume II and the methodological investigations of this volume pertains to the notion of interdependence. We now have acquired a sound perspective on the meanings of the term, which can be used to identify the extent to which two firms, governments (or other cross-state actors) are, or are not, interdependent at any point in time. There are, in effect six analytical meanings of interdependence. Each

provides a different perspective and casts light on a different dimension of the phenomena of international relations, which we here conceive of as actual and potential interactions (including transactions and exchanges) among cross-state actors.

The first meaning of interdependence we have identified is that of consumption interdependence. This is created when the products of human activity flow across national boundaries in ways in which their consumption by one cross-state actor does not wholly prevent or exclude others from enjoying or suffering from them. In this case economists refer to public or collective "goods"; we have extended this idea to include as well those products of political actions which exhibit consumption interdependence. This kind of interdependence is often a by-product of the network of actual or potential interactions constituting international relations.

Below the normal flow of such collective goods and private ones are natural, social, and political structures engendering these flows and differentially capable of terminating them or beginning new ones. The second meaning of interdependence thus follows from the first and concerns the causal relations and structures determining observed or potential cross-states interactions, including resource flows. Causal interdependencies are partially asymmetric relationships normally studied by the various natural and social sciences; they reflect cause-effect interconnections among flows, actions, and underlying structures. Although the purposes, intentions, and designs of various actors have not been introduced before defining such interdependencies, these objective, causal relations may involve the subjective values, expectations, and preferences of cross-state actors. They thus suggest yet another analytical meaning of interdependence.

The third meaning is that of cross-state sensitivities, which may be of a symmetric or asymmetric sort and may involve an actor with other actors and/or his natural and social environments. The degree of sensitivity interdependence varies with the extent to which causal interdependencies impact on events positively or negatively evaluated by particular cross-state actors, particularly their political concerns.

Interdependence refers more generally and purposively to a system of relationships or to policies designed to realize, change, maintain, or prevent value outcomes in particular situations. Policies or systems of interdependence can be distinguished from external actors and their natural or social environments. We can characterize

both international systems, their problematic situations, and the actual or potential policy responses they provoke in terms of their utility-interdependence. By this we mean the extent to which international actors attach the same stakes (or utilities) to certain goods, policies, or outcomes, that is, the extent to which their cares are conflicting or complementary. The greater the compatibilities in their utilities (what they value and how much), the more positively utility interdependent they are. Some degree of positive utility-interdependence always characterizes the consumption of collective goods (but not the consumption of collective bads or shared products with mixed evaluations). For this reason, it is important to identify ways of reordering international relations to increase access by all nations to genuine collective goods.

Against the level of systemic interdependence, a fifth analytical meaning is that of cross-sectoral interdependence. This refers to the often unconscious dependence of one actor's designs, plans, and actions upon those of other actors in other natural, economic, social, or political sectors. Cross-sectoral interdependencies inevitably also involve the causal interdependencies within or across such sectors. The policy implication here is that successful task performance involves the deep understanding and regime-coordinated mastery of such cross-sectoral, systemic interdependencies. Thus, for example, the job descriptions of organized divisions of labor can be described even more fully in terms of the often unconscious functions performed by various actors or their subunits in the realization or frustration of overall objectives. So, too, the successful production of many collective goods (including the regulation of public bads) often requires increasingly complex regulative relationships.

Sixth, and finally, there is vulnerability interdependence. This refers to the asymmetrical abilities of cross-state actors to transform their sensitivity, utility, and cross-sectoral interdependencies. An actor is highly vulnerable if it costs him more than he can afford to obtain certain systemic transformations or to prevent certain outcomes. There is an objective calculation at the basis of any attempt of one actor to change the asymmetrical relation. There are also subjective dimensions to this vulnerability. Opportunity costs and resource costs must both be taken into account.

Each of these six dimensions of interdependence has been given a preliminary treatment in the early chapters of this volume. In sum, they suggest that international interdependence refers to consumption

externalities generated by actual or potential interactions and flows, themselves the product of causal relations and structures evoking as well value sensitivities, where utilities are sometimes interdependent, where there are often unappreciated cross-sectoral dependencies, and where each cross-state actor is unequally vulnerable to such relationships. These six dimensions together serve to characterize a situation of interdependence.

It is worth noting the compatibility of these distinctions with the principal definition of Chapter I of Volume I: ". . . interdependence refers to a situation of two-way dependence between states or enterprises possessing things of value to others and thus able to indulge or threaten each other with those benefits." This definition highlights a situation of bilateral sensitivity dependence, distinguished by possessive control relations over largely private goods exercised by two very important cross-state actors, national governments, and economic enterprises. The six interpretations of interdependence which we present here as our analytical conclusion to this study encompass the definition of Chapter I in Volume I, but go beyond it to highlight the multidimensional and multifaceted nature of the phenomenon of interdependence. Our perspective takes into account both public and private goods, governmental and nongovernmental actors, subjective and objective factors, the asymmetries and symmetries involved, and the costs and vulnerabilities to each actor. Interdependence is thus a complex multidimensional phenomenon. To characterize it as a simple two-way relationship of dependence is incomplete, if not misleading. There are additional important characteristics of this two-way dependence that make it a situation of interdependence, if and when such is the case.

B. Implications for the Analysis of Energy Interdependence

Our analysis of global energy problems in Volume II reinforces the conclusion that world energy transactions and the flow of energy across national borders have given rise to a situation of genuine, partly global interdependence. The basis of today's energy system is petroleum, and the production, consumption, imports, and exports of petroleum have shaped the parameters of the world energy system, structuring a network of mutual sensitivities and vulnerabilities that meet all six meanings of "interdependence."

Thus:

1. Consumption Externalities Generated by Flows of Goods and Services

Transactions between producers and consumers of petroleum have been structured in terms of flows of petroleum in return for petroleum revenues. Although pure market exchanges of export goods for cash do not require reciprocal import relationships, such have usually occurred, differentially binding both the producers and the consumers in a well-defined situation of exchange with some degree of mutual gain. The "collectiveness" of such relationships is, however, rather parochial, far less universal than a global public good.

2. Causal Relations Determining Actual or Potential Flows of Goods and Services Across National Boundaries

It is the petroleum needs of the advanced societies that have promoted the exploration and exploitation of petroleum resources in the producing countries. This need is generated by the requirements of industrialization and the maintenance of industrial output. Indeed, access to energy is a vital factor in the production process. In conjunction with technologies of development, we would argue that the preferences and priorities of both producers and consumers have causally structured the basic flows of petroleum. Thus, some consumers have opted for a policy of simply assuring access to petroleum; others have followed a strategy of diversification, reducing reliance upon any one single source; and still others have opted for a strategy of concentration, focusing primarily on one trading partner, to the exclusion of others. The need for petroleum resources, and the values and preferences of the trading partners, together, constitute much of the causal mechanisms generating the flows of petroleum across national boundaries.

3. Cross-State Sensitivity

The network of petroleum flows has produced marked cross-state sensitivities, in that the policies of producers invariably affect the consumers' interests much as the actions of the consumers also influence the producers. In the first case, the similarity is direct, in that any attempt by the producers to change the structure of the network will immediately influence the consumers; in the second case the influence also occurs, but, in all likelihood, with a certain delay. This mutually directed influence is inevitably reflected in cross-state sensitivities.

4. Shared Utilities

The mutual sensitivities of producers and consumers are predicated upon common utilities and a high degree of positive utility covariance. Each party has distinct stakes attached to the transaction. Thus, the consumers rely heavily upon petroleum resources because modern economies cannot survive without access to petroleum. Producer nations are almost exclusively dependent upon their petroleum receipts for government revenues and for national income. In each case, this dependence upon the other is near total; and in each case the stakes each attaches to the transaction are extremely high. The gains of one party are almost always accompanied by gains to the other. Nonproducing underdeveloped countries, however, do not directly share in such relationships.

5. Cross-Sectoral Interdependence

The dual networks of petroleum and revenue flows have generated complex cross-sectoral interdependencies which are most clearly illustrated by the balance of payments issue. The transfer of funds across national borders affects the national accounts of all parties, with attendant implications of an economic, political, strategic, and communal nature. Thus, the cross-state interdependencies, whereby mutual sensitivities along one issue or policy sector (such as the economic) lead to mutual sensitivities in another (most notably the political or strategic). The economic consequences of petroleum flows have given rise to complex cross-sectoral dependencies, the full implications of which are not yet completely understood.

6. Vulnerability Interdependence in Terms of the Asymmetrical Ability of One State to Reshape Its Interrelationships

The consumer countries are obviously vulnerable to price increases or to production limitations. The ability of the producers to have an impact upon the consumers is enormous. Similarly, the consumer countries could freeze the foreign assets of the producers, withhold the transfer of funds, and so forth. Thus, the impact can go the other way as well. The actual implications of vulnerability interdependence are predicated upon the utilities involved, the cross-state sensitivities, the structure of the network of flows, the underlying causal relations, and the resulting cross-sectoral interdependencies.

TABLE 3. Methodological Maxims for Interdependence Research

A. Theories of Natural and Social Environments

- Maxim 1** Theoretical specifications (and hopefully models) should be made of the dynamics and transformability of natural and social environments external to contemplated regime participants.
- Maxim 2** But because such environments are rarely accurately predictable, a probabilistic error treatment, using appropriately specified random variables, is desirable concerning parts of the environment not deterministically modelable.
- Maxim 3** Ascertain actual and potential information and resource flows, including causal impacts from environments into major actors and actual or potential regimes.
- Maxim 4** Attention should be given to the potential often-unanticipated impacts or side effects of quasi-regime alternatives on natural environments and on social groups whose support is not necessary in the short run to sustain the inner structure of quasi-regime practices.
- Maxim 5** The findings of scientific experts with different doctrinal/value emphases must be examined, checked, and compared at least to the extent likely regime participants differ in their environmental assessments.

**B. Theoretical Analyses of Interdependence Practices
(Including Internal Environments and Regime Capabilities)**

- Maxim 6** Actor-relevant time-specific actions, sensitivity effects, resource costs, outcome trade-offs, and policy opportunity-costs should be routinely part of analyses of interdependence practices.
- Maxim 7** Policy analyses should, moreover, be structure sensitive, making explicit estimates of the relevant impacts of external environments, internal organization constraints, policies, and cross-state quasi-regimes.
- Maxim 8** The appropriate multiplicity of cross-state actors should be studied.
- Maxim 9** The subjective interests, preferences, identities, and expectations of such actors should be researched, including their assessments of alternative interface arrangements (including various regime possibilities).
- Maxim 10** Judgments of actual (or hypothetical) system functions should be supplemented, wherever appropriate, by explicit theoretical statements of operational rule structures and capability-loads analyses of them.

Maxim 11 Memory-rich specifications of quasi-regimes are to be preferred over ahistorical ones because the performance, reproduction, and self-transformation of historical systems depend importantly on memory processing capacities.

C. The Search for Successful Interdependence Policies

Maxim 12 More than one interdependence design or "possible world" should be considered (hopefully varying in terms of key objectives and values summarized in Maxims 6 and 7). Otherwise system restructuring strategies are operationally meaningless.

Maxim 13 Historical practices, including precedents, should be used for the (re)design of the multiple alternatives noted above.

Maxim 14 Sequentially explicit construction heuristics (design principles) must be explicated; otherwise their operational meaning remains obscure.

Maxim 15 Feasibility arguments about a regime alternative should spell out and make plausible the attainability of necessary and/or sufficient conditions for each order-building stage.

Maxim 16 Explicated regime construction or redesign principles must be scientifically and prescriptively subject to post-mortem analyses; otherwise statesmanship can never be a cumulative science of design.

D. The Evaluation of Cross-State Interdependence

Maxim 17 Interdependence relationships, including regimes and less consensual structures, should, at a minimum, be analyzed for the efficiency, equity, autonomy, capacity, modernization, and conservation objectives meaningful to potential participants in such relationships.

Maxim 18 Moreover, political and economic evaluations should be extended to include the opportunity costs for relevant actors of regime alternatives, not just the opportunity costs of normal policy alternatives mentioned in Maxim 6.

Maxim 19 As part of the scientific contribution to such discussion, an appropriate mix of judgmental, rational, and complex causal assessments should repeatedly be used in order to ensure relatively comprehensive quasi-regime evaluations in changing conditions of historical interdependence.

Maxim 20 Public debate and cross-paradigm adversarial science are necessary for the discovery of latent system functions (such as inequity perpetuation) and the definition of quasi-regime objectives susceptible to legitimate institutionalization.

C. Applications of Maxims to the Analysis of Energy Interdependence

Table 3 presents the methodological maxims developed in earlier chapters of Volume III. As a way of illustrating their research implications, the following discussion concretely applies them to the analysis of energy interdependence. Some of these have already been followed in the research of Volume II. Others require further investigation.

- Maxim 1 Theoretical specifications should be made of the structure of the world energy system in terms of the natural and social environments which shape its parameters. Production, consumption, and reserves of energy within national borders need to be delineated as well as changes in such patterns over time.
- Maxim 2 In seeking to model the dynamics and change in the natural environment of the world energy system (that environment which shapes its parameters), it is desirable to incorporate those aspects of the system whose structure and behavior are not well specified in terms of probabilistic error systems.
- Maxim 3 Delineate empirically the flows of energy across national boundaries as well as the flows of information and technology designed to condition these flows. Such delineation will then allow the next step, namely, determining the causal relations that shape the flows and that provide the initial information input into actual or potential energy regimes.
- Maxim 4 Following from the above, the next step would be to examine the unanticipated consequences of emerging patterns of energy flows and associated regulative attempts, which we have conceptualized as quasi-regimes. Particularly important are effects upon those actors who are not central to the existing regime. For example, the consequences of present regulative practices for the non-oil-producing countries need to be examined, in addition to the effects upon both producers and consumers. The higher order consequences of increased petroleum prices are illustrative of the unanticipated consequences of existing quasi-regimes. Alternative quasi-regimes beyond crisis-handling coordination efforts are not yet fully articulated,

but delineating different preferred perspectives can be undertaken from an assessment of stresses and strains upon prevailing regime rules.

Maxim 5

In the course of such investigations it is imperative that different scientific traditions with different ideological perspectives be taken into account. Such differences lead to divergencies in definitions of reality and in evaluations of the attendant energy "problems." Thus, we have noted that different participants in the present world energy system define the issues differently, draw upon different scientific traditions, and propose different solutions. Reality in those terms does indeed wear many guises. "Expert" assessments of the world energy situation vary considerably depending upon their geo-political perspective, with the "crisis" being viewed differently from Washington, Paris, Teheran, Moscow, or Peking. The "true" view is relational.

Maxim 6

The intricate patterns of interdependence in the present world petroleum system highlight the extent to which one nation's policies become the constraints of another. Thus, the policies and actions undertaken by each state are to be (and have been) systematically codified as a means of identifying the ties that bind the participants in the world petroleum system, their assessment of resource costs, and trade-offs associated with alternative policies. Opportunity costs must be taken into account: but this is an area in which there exist no systematic investigations, rendering all existing studies fundamentally flawed.

Maxim 7

Policy analyses pertaining to the world energy system must take into account the structure of that system in terms of its basic parameters, taking explicit account of the impact of policy outcomes upon the external environment, most notably upon production, consumption, and basic reserves. Account must also be made of the policy impacts upon international organizations (such as OPEC) and upon the multinational corporations, most particularly in terms of the factors that would constrain their respective behavior. (One of the most important drawbacks of present paradigms of policy analyses lies in their insensitivity to structural configurations and to environmental constraints. The present energy situation points to the criticality of examining

multiple impacts. Thus, for example, any consumer policy designed to "break up" the producer petroleum cartel needs to be assessed in terms of its impact upon the structure of the world petroleum system and the unanticipated consequences that might make such a policy extremely undesirable.)

Maxim 8

It is increasingly apparent that the consumer countries no longer control the world petroleum system, a consideration that has come as a surprise to both the consumers and the multinational corporations. This situation is a perfect example of the myopic perspective generated by ignoring the multiplicity of cross-state actors and their ability to influence the structure of the world petroleum system. Thus, it is imperative that a cross-state perspective be formally interjected into the investigations so as to dampen the purely state-centric Realpolitik view of international politics that accords a dominant role to the consumers of petroleum while downgrading the emerging position of the producers.

Maxim 9

Given the divergent goals, objectives, and policies of the actors in the world petroleum system, it is imperative that their own assessment of their situation and position be undertaken in order to obtain an understanding of the issues as they see them. Equally important is to obtain their subjective assessment of the alternative world energy regimes, both preferred and expected. In this fashion, it might be possible to compensate for the ethnocentric perspective that governs almost all existing research on the global energy situation. Much of it is written by scholars in the West who attribute their own assessment to the actors involved and impose a systematic Western bias. (Similar biases prevail in other areas of the world; few investigators have obtained a macro-systemic view of the interests, identities, and expectations of various actors.)

Maxim 10

In viewing the world energy system and evaluating the functions performed by its various components and by the participants in it, it is necessary to delineate the actual procedures and rules of operation that lie at the basis of the system. Thus, the actual "rules of the game" need to be identified as well as those that are regarded as such but,

in reality, do not perform such a function. For example, the multinational corporations interact with the producing countries in agreed-upon fashion with acknowledged substantive and procedural methods. Indeed, the multinationals are often accused of being the "tax collectors" of the producer governments; this accusation points to the existence of shared modes of behavior and mutually directed expectations between the producer governments and the multinationals and does not necessarily point to conscious collusion. Distinguishing empirically between shared substantive and procedural operational rule structures on the one hand and shared goals and objectives on the other is an important aspect of such an investigation. The strains and stresses placed upon operational rules of a system must also be identified; stresses often provide important indication of prospective or anticipated system change. Thus, the present malaise, if not outright dissatisfaction, with prevailing rules and regulations underlying the present world petroleum system as expressed by all the participants in that system, amounts to an important indication of a regime in transition: the present quasi-regime may gradually give way before a new, participatory, and consensus-based world petroleum regime.

Maxim 11 In any assessment of the prevailing structure at the base of the world petroleum system, it is important not only to determine its historical origins and its structural and functional characteristics (much as has been done in Volume II), but to develop empirically based specifications of the important events and developments which have, over time, shaped the historical situations. These events and developments constitute the "memories" of system actors, or the empirical scenarios which have provided the background for prevailing ground rules, operational codes, and regulative regimes. Thus, the gradual learning process which OPEC has been engaged in over the past decade has been based upon an examination of memory-rich systems, generating collective memory systems composed of past events and interactions with the consumer countries and with the multinational corporations. Articulating and specifying the contents of this "collective memory" is a necessary requisite for an understanding of the situational contents and processes which have given rise to the present quasi-regime operative in the world petroleum system.

Maxim 12 In drawing conclusions among the preferred or expected regimes to coordinate petroleum transactions, the investigator needs to articulate and specify the attributes of several competing regimes predicated on competing preferences and priorities and designed on the basis of different vantage points in the world petroleum system. Thus, for example, present concerns with the high price of petroleum have given rise to numerous proposals regarding alternative price structures. None of these are fully articulated, nor are their characteristics well specified. More important, with few exceptions, they all emanate from the consumer countries, rendering little attention to the preferences and priorities of the producing states. As a methodological imperative, the specification of alternative futures needs to be made. At the very least, such an effort would place the prevailing patterns of interaction in sharper perspective and would assist in delineating the possible alternatives more systematically than would otherwise be the case. It would also draw attention to alternatives that might not have been intuitively obvious.

Maxim 13 The analysis of interactions among the major actors in the world petroleum system should be employed as input data into the structuring of regime alternatives and analysis of their implications and consequences. Transactions between the corporations and the consumers during the decades of the 1950s and 1960s have shaped the present world petroleum situation and have led to the formation of OPEC and the attempts of the producer countries to change the quasi-regime that prevailed prior to the formation of that organization. Historical practices of the multinationals provide important clues into the rules and regulations that governed the actual functioning of the world petroleum system, as an analysis of these practices will provide insights into the precedents that were employed and insights into departures from such precedents. The analysis of historical practices and precedents would enable a more rich and substantive input into the design of alternative futures.

Maxim 14 From the above follows the necessity of formulating explicit design principles addressed to the structure of alternative energy regimes predicated on alternatives rules and modes

of procedure. The specification of such design principles ought to be predicated on alternative definitions of "reality" and their implications (both intended and unintended) explicitly investigated.

Maxim 15 Each alternative regime ought to be accompanied by a delineation of a set of sufficient conditions to make them attainable and a specification of the plausibility and possibility of attaining each requisite condition. The parameters of such designs are inevitably set by the structure of the world petroleum system and by its natural and social environments. The policy environments define the options available to each state and the plausibility of attaining each option. Thus delineating the requisite conditions for alternative regimes would take into account both the decision systems involved as well as the structural and social contexts.

Maxim 16 The design of interdependence alternatives must be accompanied by post-mortem analyses of past and perspective regime practices. In the context of energy interdependence such analysis would necessarily draw upon a careful record of the developments that have occurred between the time at which the real or alternative regimes were specified and the time at which the post-mortem is to be undertaken. Explicit provision for a lag structure in the research design needs to be made. Thus, it would be possible to examine the consequences of specific developments in the world petroleum system and their effects upon the prevailing coordination or regulation efforts at any point in time. By inference it would also be possible to comment upon their implications for alternative regimes.

Maxim 17 Interdependence relationships in the world energy system need to be examined from a multiperspective and multi-dimensional view, taking into account: (a) the efficiency of petroleum production methods and methods of transportation distribution; (b) the autonomy (or lack thereof) of different actors, including the multinational corporations and the Organization of Petroleum Exporting Countries; (c) the capacity and capability attributes of different actors as well as of prevailing quasi-regimes.

- Maxim 18 The opportunity costs of alternative economic and political arrangements confronting every nation need to be made explicit. Moreover, the value of alternative courses of action must be articulated by the investigators, particularly when possibilities for conflict or potentials for cooperation exist. Any confrontation strategy between consumers and producers, for example, needs to be viewed in terms of the opportunity costs to each participant, particularly to the initiators. This is especially relevant in situations in which the consumers might seek to "break up the cartel." They would invariably need to take into account the costs incurred should the producers decide to "blow up the wells."
- Maxim 19 As part of the overall research design following the above maxims, a clearly specified mix of judgmental, rational, and complex causal assessments should be systematically employed to obtain repeated comprehensive evaluations of changing conditions in the international system and to evaluate the implications of these conditions for the development of alternative regimes or for the stresses and strains that might be encountered by the prevailing quasi-regime. This mix is critical. There is a need to go beyond largely judgmental efforts used by the State Department in the past, without losing their valid contributions. Even the Mesarovic-Pestel models need improvement in this regard.
- Maxim 20 Public debate regarding the structure of regimes, the scientific traditions at the bases of investigations of regimes, and of the the international and national institutions designed to govern interactions in a world petroleum system needs to be encouraged. Developing both context and structure for such debates involves recourse to procedures and strategies not yet fully developed. But the criticality of access to energy to all nations is such as to necessitate active public involvement and public debate on evaluation, assessment, design, and institutional issues. The structure of these debates will invariably be different from the structure of the procedures noted here as methodological maxims. But the mix of judgmental, empirical, historical, and adversarial approaches would clearly be important dimensions underlying the evolving structure and forum of debate.

D. Generalizing the Above Approach

Having given a relatively detailed set of suggestions concerning further research into energy interdependencies, it is not necessary to illustrate in detail the research approach suggested by the present volume. But it should be emphasized that the process of respecifying (and adapting) the methodological maxims of Table 3 to other content areas could be a profitable exercise. Thus the table may serve a bureaucratic function as a relevance checklist to be used by the State Department or other institutional actors funding, reviewing, or formulating research. If our own experience with the dominant body of economic- and engineering-oriented research on energy is a reliable guide, we suspect much currently discussed research both within and outside government is of limited "interdependence relevance" in the terms of Table 3.

Within the larger content areas of the present study, we would emphasize also the need for studies of commodity flows in similar terms. The subject of commodity flows in the minerals area, discussed in Appendix A of Volume I, cries for a more vigorous analysis along the lines of the present chapter. Only by doing so, will governmental officials have systematic evidence to use in discounting simplistic arguments in current public debates about American "dependence" on particular mineral suppliers.

Although not studied here in detail, information and resource flows in the scientific and technological areas also strike us as especially important areas for systematic interdependence research. Surely these flows, and their potential alternatives, reflect as high a degree of international dependence and interdependence as any of America's economic community or security relations.

In sum, the major methodological recommendation of this volume is the consistent application of a multifaceted, design-oriented approach to the analysis of partial global interdependencies.